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ABSTRACT

This book evolved from projects that participants in a training institute for sex desegregation developed to eliminate sex bias in their classrooms and school districts. The first chapter of the book delineates recent research in sex bias related to achievement in mathematics and science. The following five chapters present projects on the following themes: (1) evaluation for sex bias in school mathematics and science programs, (2) communication with and education of parents and staff, (3) the use of word problems and of a unit on spatial relationships, (4) career awareness for males and females, and (5) the use of both female and male role models in science careers. A large resource section is appended which includes project data collection instruments, relevant documents, and instructional materials. (Author/MK)

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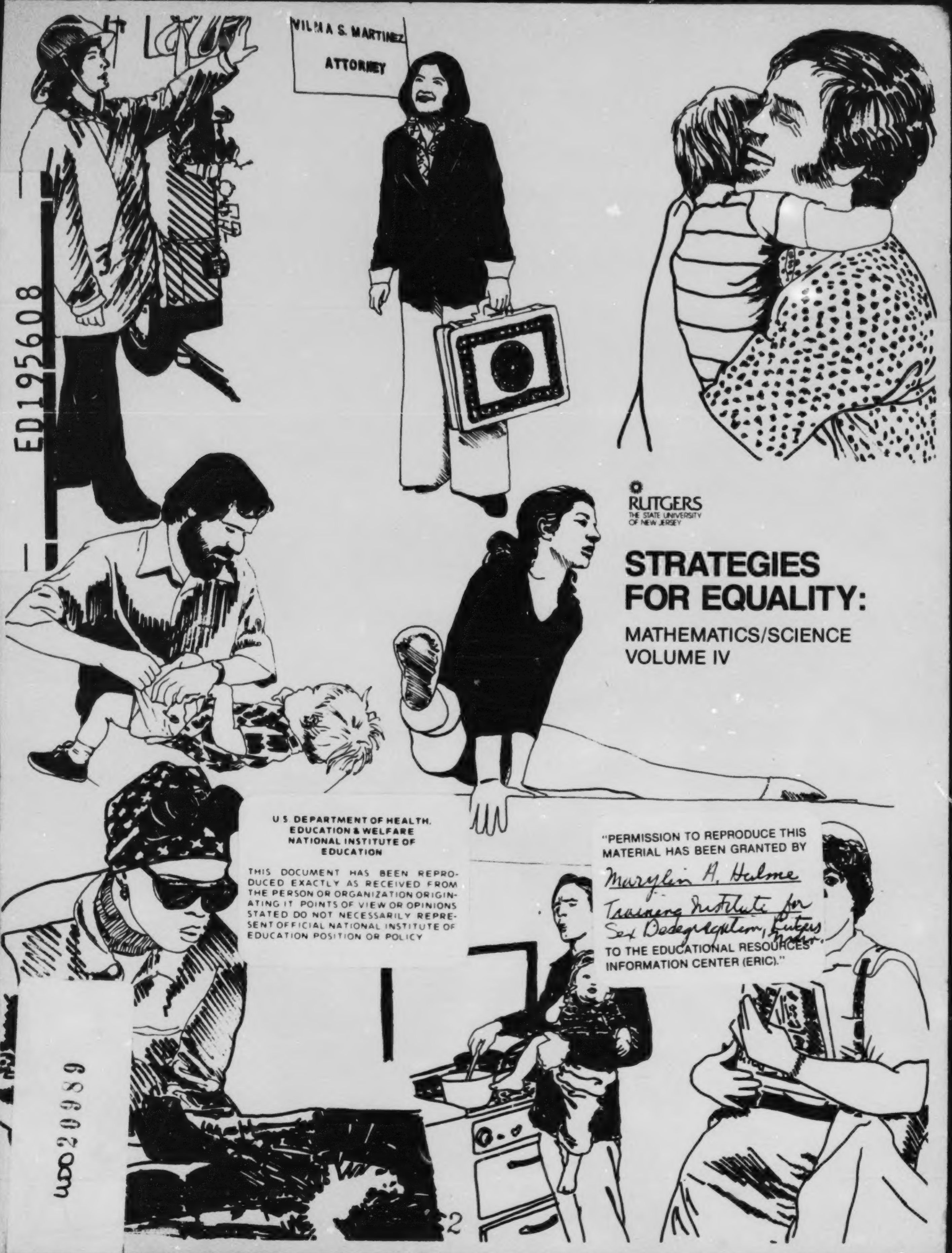

RUTGERS
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STRATEGIES FOR EQUALITY:

MATHEMATICS/SCIENCE
VOLUME IV

U.S. DEPARTMENT OF HEALTH,
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STRATEGIES FOR EQUALITY: MATHEMATICS/SCIENCE
VOLUME IV

Training Institute for Sex Desegregation
of the Public Schools
Women's Studies Institute
Federation Hall, Douglass College
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The Training Institute for Sex Desegregation of the Public Schools at Rutgers University is sponsored by the Women's Studies Institute. The purpose of the Training Institute is to improve the ability of school personnel to deal effectively with educational changes mandated by federal and state sex desegregation laws. Activities include training for all levels of staff to promote equal opportunity, as well as specialized workshops dealing with curriculum in specific subject areas.

* * * * *

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PREFACE

The Training Institute for Sex Desegregation of the Public Schools, Rutgers, the State University of New Jersey, was established in 1975 under a Title IV grant from the U.S. Department of Health, Education, and Welfare. Its purpose is to assist schools in their compliance with legislation that prohibits sex discrimination. These laws--Title IX of the Education Amendments of 1972 and N.J.S.A. 18A: 36-20, and the implementing regulation N.J.A.C. 6:4 et seq.--mandate that public school districts eliminate racism, sexism, and ethnocentrism, and that all schools institute affirmative action programs on an on-going basis.

To help schools meet these requirements, the Training Institute has developed (among its other programs) two series of courses for its participating districts:

- New Choices Courses: A two-day course, six hours each day, designed to heighten awareness of sex discrimination in schools and society;

- Curriculum Development Courses: A three-day course, seven hours each day, in which individual subject areas are explored for sex role stereotyping problems and solutions.

In the spring of 1977, the Institute offered a curriculum development course entitled: Training in Equity in Mathematics and Science, with the assistance of Dr. Susan G. Marchand, Department of Mathematics/Computer Science, Kean College, Union, NJ. The participants included elementary school teachers, secondary school teachers of mathematics and science (including biology, chemistry, physics), and district curriculum specialists in science and mathematics.

The three-day course content included:

-- An overview of existing research in male and female achievements in mathematics and science;

-- An evaluation for sex bias in textbooks used in the participants' school districts, in course enrollment, and in staff gender;

-- Activities dealing with math anxiety;

-- A panel of women in the sciences;

-- Brainstorming of techniques to overcome problems of sex bias in mathematics and science.

This book has evolved from projects that course participants developed to detect and eliminate sex bias in their classrooms and school districts. The projects include the following themes:

- -- Evaluation for sex bias in school mathematics and science programs;
- -- Communication with and education of parents and staff;
- -- The use of word problems and of a unit on spatial relationships;
- -- Career awareness for females and males;
- -- The use of both female and male role models in science careers.

Chapter I delineates recent research in sex bias related to achievement in mathematics and science, thus demonstrating the necessity for courses and projects to make educators aware of sex bias and encourage affirmative action for its elimination. A large resources section closes the book.

The Training Institute for Sex Desegregation wishes to thank not only those participating teachers and administrators for their efforts and criticism, but also the students who gave many valuable insights.

A special thank you goes to Dr. Susan Marchand who developed and conducted the course, provided liaison for the projects and wrote this volume; and to Marylin A. Hulme for her editorial work.

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CHAPTER I

RESEARCH ON MALE/FEMALE DIFFERENCES IN MATH COMPETENCY

Several questions about a curriculum development workshop to encourage equity for females in mathematics and science surface immediately: What is such a workshop's purpose? Does its existence imply the presence of discrimination in the classroom? How will this workshop affect behavior and curriculum in math/science classrooms to ensure an objective approach toward gender? A look at research on sex differences in mathematics and science reveals the need for sex equity training in math/science.

Although fear of math affects a majority of children and adults of both sexes, according to Mitchell Lazarus (1), this fear, coupled with traditional societal influences, creates a disproportionately large number of females who are prone to math avoidance and/or math anxiety. Although the math-anxious person is also a math-avoider, the difference between the two, in much too simple terms, is that the math-avoider may have always done well in the subject, but opts not to study more math. The math-anxious person is so disabled by failure at math and feels so uncomfortable when contemplating its study, that psychosomatic physical symptoms, such as sweaty palms, sick stomach or nausea, develop.

Math-avoidance and math-anxiety act as critical career filters. Lucy Sells (2), a sociologist at the University of California at Berkeley, found in a 1973 study that among entering students, 57 percent of males but only 8 percent of females, entered the university with four years of high school math. Because 92 percent of first-year female university students were unable to qualify for calculus or intermediate statistics courses required in 15 of the 20 available majors, they were crowded into the five remaining fields: humanities, music, social work, elementary education, and guidance and counseling. Such differential achievement was due to sex role stereotyping and math avoidance. There is some hope, however. By 1974 (Sells, 2), 65 percent of entering males and 22 percent of entering females had the requisite four years of math.

In addition to stereotyping, a commonly held myth presupposes that males are naturally more adept in math. Elizabeth Fennema and Julia Sherman (3), of the University of Wisconsin, researchers of sex differences in math for several years, have not been able to pinpoint consistently significant differences between the math abilities of boys and girls who have taken the same math courses. Rather, the continued stereotyping of math as a male domain leads to the expectation that the female mind is not good at figures; it then becomes a self-fulfilling prophecy. Fennema and Sherman gathered data in four Madison, Wisconsin, high schools on many aspects of the problem: math achievement; spatial visualization; attitude toward success in math; stereotyping of math as a male domain; perceived attitudes of mother, father, and teacher toward math learners; affectance motivation (behavior that shows a lasting focus and has characteristics of exploration and experimentation); confidence in learning math; utility of math;

number of math-related courses; number of space-related courses; and the amount of time spent outside school in math-related activities. Their data indicate that many females have as great an aptitude for math as their male counterparts. When the amount of math the students studied was kept constant, half of the students enrolled in math showed no sex-related differences in math achievement or space visualization. Thus, the pattern of differences in these and affective variables strongly suggests the important influence of sociocultural math ability factors.

In a British review of 130 or more research studies done primarily in Britain, America, and Australia, Alison Kelly (4) found that school and home background, teachers, and parents influenced math and science behavior. For example, in single-sex as compared to coed schools, female students in single-sex schools studied more science and had better attitudes toward science -- even where there are more severe staff shortages and poorer lab facilities than in male or coed schools. Although attitudes toward the science teacher did not greatly affect science attitudes, the research report did state that females are more influenced by their science teachers than are males. Thus an enthusiastic staff female may help to produce more scientists.

The home, too, seems to be a key factor. General interests in science in the child's home encourages study. Parents who buy their daughters erector sets, tinker toys, building blocks, and three-dimensional models provide learning experiences that aid formal studies later. Girls who have large riding toys, who learn to climb and move through space, and who participate in sports activities are more apt to excel in spatial visualization.

Math anxiety is a serious handicap that is often handed down from mother to daughter, as the bemused father looks on. Research shows that beginning in the 7th grade, girls go to mothers for homework help; and boys to fathers (5). Too often the mother says that she cannot help with math or science and sends the child to daddy, further emphasizing female ineptitude in these areas.

John Ernest (5), a statistician at the University of California at Santa Barbara, noticed one day that his entire department was male, except for the secretarial staff. This led to an undergraduate research seminar, "Mathematics and Sex." The seminar's findings assert that elementary school boys and girls each think their own sex does better in math, although both still express positive attitudes toward it. A small survey revealed a significant difference in teacher perception of female and male achievement in mathematics. Whereas almost half the teachers expected their male students to do better in math, none of them expected their female students to do better. Perhaps teacher expectation mirrored student performance. Teachers at the Training Institute workshops commented that the high school honors courses are predominantly male, and that since teachers chose students for these courses, they will rethink their selection processes, taking into account the Pygmalian effect.

Self-esteem is also affected by attribution. Males externalize failure while the females who tend to suffer from lower esteem internalize it. That is, the boys tend to blame poor performance on everything but their ability, while the girls tend to think they "just don't have it." And, finally, because male students are highly career-oriented, they are aware of the necessity of mathematics for the careers they envision, even though they may not like the subject any better than the female students do.

Patricia Casserly, of the Educational Testing Service, Princeton, N.J. (6) is conducting an on-going study to determine what constitutes the best math environment for girls. After examining all of the schools where a large percentage of girls take the Advanced Placement Math Examination, eight schools of differing location, background, and population were chosen for the study. Students answered questionnaires about their personal backgrounds, educational experiences, attitudes toward math and jobs, and future expectations. Casserly also extensively observed classes in each school. Her results thus far indicate that, while none of the schools have any organized program to encourage women, the schools succeed because they share several attributes: math teachers in these schools thrive on teaching students brighter than themselves; the teachers are not threatened by divergent thinking; they are not looking for specific answers. In many instances, they use students as tutors for younger children. Although many of the students do not like mathematics, they realize its necessity. Thus, a key factor in the encouragement of further study is a good climate for math. After all, students do not drop out of the English sequence because of trouble with paragraphs!

It is interesting to speculate about the correlation between the female math avoidance/anxiety syndrome and the choice of elementary education as a career. This becomes an important element in the math achievement of succeeding generations when one considers that girls identify more with their female elementary school teachers than boys do, and therefore may be learning their math anxiety from these models.

If teachers have math anxiety, they must become aware of it. Once free of it, they can help their students to overcome math discomfort. Inservice programs which help elementary teachers to become aware of and to master their own feelings will have beneficial results in the classroom. To help overcome teacher math problems, Alice Schafer (7), of Wellesley College, suggests team-teaching in the early elementary grades and believes that K-6 math specialists should be licensed.

Some studies have shown a gender-based difference in scores on spatial relations. This skill deficiency may have its origin in sex biased treatment of males and females during early childhood. Lenore Blum (8), of Mills College, Oakland, California, finds that she can raise women's ability in spatial concepts in one semester. Elementary and secondary teachers can also introduce exercises and games that develop these skills. These include the use of two- and three-dimensional tick-tack-toe, Tangrams, Geo-D-Stix, and space straws. Because it has been found that women athletes excel in spatial relations, movement through space (such as track participation) needs to be encouraged.

Another element of a good math climate is an emphasis on process, rather than on solving mathematical problems. When students' answers are wrong, especially in word problems, the cause is often that the students have misunderstood the question and are answering a different question from the one intended. It is the teacher's job to find out what those questions are. If word problems are encountered daily, not just in a special chapter, students will be more able to relate the abstract and operational math they are learning to the real world. Jean Smith (9) of Wesleyan University favors the abolition of timed tests. She suggests it is only the doctor and the pilot who need to work quickly.

Lenore Blum states that math anxiety will be substantially reduced if a student has at least one positive experience in learning math. There must be provision for success at the heart of all successful discussion groups, awareness sessions, and math clinics. Students, teachers, and educational policymakers must realize that math abilities are accessible to the majority of the population when properly taught and accompanied by specific support.

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CHAPTER II

SEX BIAS: RECOGNITION AND EVALUATION

Jożef Boniakowski *Eatontown School District*	Maxine Shepard Ingram *Franklin Township School District*
Elaine Parker *Piscataway School District*	Richard E. Chandler *Hamilton Township Public Schools*
Joseph Ziemba *Pascack Valley Regional High School*	Wilton H. Kimmer, Jr. *Franklin Township School District*
Richard Rose *Monmouth Regional High School*	E. Bruce Yaches *South Plainfield School District*

A successful program in sex desegregation occurs in an atmosphere that anticipates positive change. The first element of action for change is recognition of bias. The need for intervention and movement toward implementing a sex-fair curriculum and activities will be more readily accepted by the educational community once the curriculum has been evaluated to see where sex bias exists. The evaluation programs should involve the entire community: students, staff, and parents.

The following studies were selected because they concentrate heavily on the evaluation aspect, and because they provide a variety of methods for creating awareness of sex bias in the math/science disciplines. Many also include assignments and discussion to overcome the bias and alleviate the problems; staff members from other disciplines participated in some programs.

Survey of Seventh Graders: Attitudes Toward Math/Science

To demonstrate to junior high school students sex differences in attitudes toward science and mathematics, Jożef Boniakowski, Eatontown School District, created an instrument for self-awareness (see Appendix II-A for a copy of the questionnaire). The attitude survey was completed by 178 male and female seventh graders who ranged in academic ability from below average to above average. The goal was to aid students in evaluating their own attitudes toward math/science and their attitudes toward women in math/science generally. A useful spin-off from the survey was that it also revealed teacher attitudes and their effects on the attitudes of the students themselves toward math/science.

The student survey was followed by class discussion, and a day was set aside to examine classified advertisements in large newspapers to review those jobs that related to math and science. In most cases, students discovered that many occupations and vocations which they had not connected with math or science do need mathematics preparation. Students realized the importance of high school math.

A Survey of Sex Bias Among High School Sophomores

Elaine Parker, Piscataway High School, conducted a study to determine if there was sex bias among students about intellect and ability in math/science, whether this was influenced by the home or other areas, and how this affected students' course selections. Parker's 32-question survey is complex (for a copy of the questionnaire see Appendix II-B). The questionnaire was completed by 122 high school sophomores. The table of results follows, showing the focus of the questions.

Focus of questions	Percentage of sex-biased answers	Percentage of unbiased answers
Male/female intellect and ability	32%	68%
Sex bias in occupations and educations	46%	54%
Sex bias in child-rearing	37%	63%
Sex bias in the home	54%	46%
Knowledge of restrictions by gender	41%	59%
Students' biases	60%	40%
Sex bias toward housework	36%	64%
	Main Source	Percentage
Information about occupations	Parents	59%
	Guidance counselors	18%
	Peers	15%
	Teachers	8%
	Decided by	Percentage
Selection of school courses	Self	92%
	Guidance counselors	4%
	Peers	2%
	Parents	2%

Results of the survey suggest that where there is a home bias, the students exhibit the same bias. While traditional views concerning child-rearing and housework still exist, as does traditional role definition in the home, intellectual abilities are less restricted by gender. A curious conclusion is that teachers and guidance counselors are not important sources of job information: a majority of the students said parents are the main source of information on occupations, and their student peers were overwhelmingly influential on their choice of courses.

Suggestions

The questionnaire contains a blank in which respondents fill in their gender; it would be of interest to do a complete item analysis to determine whether one sex is more biased than the other and in what areas each sex displays bias. The author also suggests changing the question about having confidence in a male nurse to confidence in a male telephone operator because the question of male identification and homosexuality might have overshadowed the intent of the question.

Attitudes of Capable Female Junior and Senior High School Math Students Toward Sex Discrimination in Math/Science

To analyze feelings of sex discrimination among mathematically capable high school students, John Ziemba, of Pascack Valley High School, developed a questionnaire. Eighty-one females who were enrolled in third-year math and who planned to continue or who were already enrolled in fourth-year math completed the survey (for a copy of the questionnaire see Appendix II-C). Because 14 of the 15 questions require answers of "no," "yes," or "undecided," this questionnaire is easily graded. Only one question asks for a written opinion. In 11 of the questions, a "yes" response indicates a discriminatory attitude.

Some of the answers provided useful information about attitudes, fields of study, and parental attitudes about careers. The girls overwhelmingly answered that parents did not discourage their interest in mathematics and science careers. They also felt strongly that teachers did not display discriminatory behavior. The girls felt strongly that women should have careers and families, but they believed that men feel there is a conflict; in later discussion, a few students thought more information was necessary to express an opinion about men's feelings on this subject.

Sixty-eight percent of these women students were planning to enter a mathematics or science field; the majority believed that there are few women in these fields because of past attitudes.

After the answers were completed and the results tabulated, four coeducational groups of 20 students each discussed the questionnaires. Students seemed quite anxious to express themselves, and both sexes were enlightened by each other's views. The consesus of feelings was that this topic is a worthwhile subject for discussion.

Suggestions

The survey can be adapted for use by male students; better discussion would result if it were answered by both sexes and the results tabulated by sex.

Survey of High School Seniors' Parents on Factors Influencing Student Choice of Post-Secondary Careers

If parents influence student career choice, it would be helpful to involve them in activities that make them aware of sex bias. Richard Rose, of Monmouth Regional High School, devised a questionnaire to determine whether parents influence a student's choice of careers. (See Appendix II-D for a copy of the questionnaire.) An enclosed, introductory letter details the nature and purpose of the project, and allows for anonymity and for deletion of any questions parents deem intrusive. The forms were distributed to approximately 100 seniors studying either senior science or fourth-year math; only 48 were returned. Most parents indicated that they helped their child in career decision-making and that they considered a career in the math/science area a good choice. The majority also felt that sex discrimination exists in math/science fields in education, industry, and government. (For complete results of survey, see Appendix II-D.)

Suggestions

A better return might have resulted by mailing the survey and a return envelope to each parent. Such a study could be used to determine whether there are wide differences in family backgrounds and answers. Even more interesting would be to compare the questionnaires of senior students enrolled in science or math with those of seniors who had chosen not to continue with math and science beyond their second or third year of high school.

Maxine Shepard, a science teacher at Franklin High School, wished to assess whether the use of math and science had affected parental career performance or job choice. She gave 70 students two copies of the questionnaire to be completed by both parents/legal guardians. While students were awarded points for returning the questionnaires, only 23 were returned of which only 18 were complete. (This again points up the problem of student-carried surveys.) Nineteen parents out of 23 applied math-related abilities to their job situation. The majority indicated that they stressed the importance of math/science to their children (question 7) and 19 out of 23 denied that they had ever conditioned their children to believe that math/science is strictly a man's subject area (question 14). (For survey and results, see Appendix II-E.)

Suggestions

When asking for parent participation, teachers would show a certain sensitivity to students of one parent families by sending one form home. If there is more than one parent, the form can be filled in jointly.

Evaluation of Elementary School Science Textbook Series for Sex Role Stereotyping

The purpose of Richard Chandler's study was to review the pictures in three newly adopted elementary school science textbook series to see if females and males are depicted equally. The pictures of both males and females "actively involved in science work" were counted for the three series at each grade level, and percentages were then compared. (See table in Appendix II-F.)

The three text series evaluated had been chosen because they met the needs of the Hamilton Township School District for a quality, "thorough and efficient" elementary science program:

1. McGraw-Hill (1979)
   Gateways to Science (Gateways)
2. Silver Burdett (1978)
   Science: Understanding Your Environment (SUYE)
3. Houghton Mifflin (1975)
   Modular Activities Program in Science (MAPS)

Percentages of males and females in the pictures were used to provide a standardized method of comparison. Regardless of the total numbers of pictures found in each grade level and/or in each individual text, a comparison of the relative percentages produced an adequate avenue for comparisons.

Although the next step might be a more sophisticated statistical analysis, Chandler decided to use a subjective, inferential analysis to prevent cluttering the results with too many numbers. It would be possible to determine chi-square levels of significance or an analysis of variance measure or some type of correlation coefficient interpretation.

The results indicated that the McGraw-Hill Gateways (1979) series has the most consistently balanced males and females in the illustrations. The widest difference is at the sixth grade level, where 12 percent more males than females are depicted. At the fourth grade level an exact 50/50 representation of the sexes indicates that a balanced approach can be achieved.

The Silver Burdett SUYE (1978) series shows inconsistencies in gender representation: there are 24 percent more males pictured in the grade 4 text and 26 percent more in the grade 5; while at the grade 3 level, an almost 50/50 split occurs. These data indicate that the publisher needs to review some of the volumes in the series to gain an equitable balance.

The Houghton Mifflin MAPS (1975) series shows the most consistently male-dominated illustrations, ranging from 20 percent more males in the grade 1 book to only 10 percent more in the grade 2 volume. An exception is that only a 3 percent difference in numbers of males and females was seen at the grade 6 level.

After looking at the three series, the conclusion is that significant strides have been made in the McGraw-Hill 1979 series, while the Houghton Mifflin series, which has the oldest copyright date, has the most biased illustrations.

As a result of this study, Hamilton Township has added one more criterion--sex-role picture evaluation--to its current procedures for assessing and evaluating possible textbooks.

In future studies in addition to counting the females and males in the pictures, a check should be made for stereotyping of activities depicted: Are girls shown in passive or home roles while boys are active and in outdoor roles?

A Five Lesson Unit on Women in Science: For High School

To familiarize his junior and senior chemistry students with women in science, Wilton H. Kimmer, Jr., Franklin High School, created a five-lesson unit which began with a pretest to determine how many of a list of 21 women scientists the students could identify. (See Appendix II-G for the pretest.) Most students could identify no more than one woman. Interestingly, the chemistry textbook used in the course the students were taking included only one woman among 24 biographies of famous scientists.

In order to show that women have contributed to science, the students were given an assignment to research a woman scientist. They drew lots for a name, an activity which in itself, by the plethora of names, proved the point. Guidelines for the reports included: dates of birth, health, field of study, family life from childhood to adulthood, accomplishments, and one outstanding attribute. Two weeks were allowed for student research, preparation of oral reports, and discussion.

When the posttest was given, 17 of the 21 women scientists on the pretest list were familiar to the students. Not only did students learn about contributions of women to science, but they were enthusiastic about the project. As a result, this unit will become a part of the chemistry curriculum of Franklin Township.

Identification and Guidance for Capable Girls Who Do Not Continue in Mathematics

E. Bruce Yaches decided to identify those girls in mathematics courses at South Plainfield High School whose grades indicated that they were capable mathematics students but who were not continuing their math studies. The goal was to determine the causes of diminishing female math enrollment. For example, out of the 164 males and 189 females enrolled in grade 9 at South Plainfield High School during the year of the study, 68 of the males (42 percent) and 83 of the females (44 percent) were taking academic math courses. But in grade 12, when the total grade enrollment was 187 males and 183 females, 60 males (32 percent) and only 27 females (15 percent) were taking math. While both male and female math enrollments had dropped, the female had dropped considerably more than the male by grade 12.

In order to identify the capable female dropouts, teachers provided the following information: total enrollment in each section, number of girls enrolled, number of girls maintaining at least a C average, number and names of girls with at least a C average who were not planning to continue math studies.

Then guidance counselors were notified of the project (see memorandum and questionnaire, Appendix II-H) and sent career information literature to use in speaking with the identified group. The girls were encouraged to attend the district-wide Career Day, at which women in math and science would speak. Yaches also met with the district's affirmative action officer to plan other ways to correct the imbalance in senior math classes.

However, only ten girls doing at least C level work who were dropping math could be identified. If achieving girls are not dropping out, then perhaps the key factor is female underachievement, which may be caused by a perception that math is inappropriate for females. This hypothesis requires further investigation: a comparison of female aptitude test scores with math grades could be made to find out who was not performing up to ability.

Suggestions

After identification of the underachievers, follow-up work to encourage math achievement might include:

> Meeting with counselors to awaken them to the problem and enlist their aid in solving it;
>
> Counseling those identified as capable but not performing up to capability;
>
> Field trips to installations where successful women in the sciences are found;
>
> Career days that provide female role models in math and science fields.

(For details on some of these activities, see Strategies for Equality, volume I, Part 1.)

CHAPTER III

REACHING OUT TO PARENTS AND STAFF

Ruth Demkovich Mooney
Hamilton Township School District

Theresa Farinella
South Brunswick School District

Herbert S. Herman
Bronx (NY) Community School District #10

Daniel T. Jankelunas
Paramus School District

Once a problem of sex bias is recognized, much detailed planning is necessary to implement an overall program in sex desegregation within a school system.

Certainly, the new program would receive a warmer welcome if the school staff were to include parents and the community in curriculum planning. Here, too, an awareness of sex bias in the classroom and in the school will attune parents and students to the ramifications of this problem in society. The more people who are actively engaged in intervention to change sex stereotyped roles, the sooner sex bias will be overcome. Further, the New Jersey Regulations on Equality in Educational Programs encourage community participation in curriculum planning to end sex, race, and ethnic bias (see Appendix III-A for the regulations).

Math Anxiety Awareness for School Staff

Ruth Demkovich Mooney, of the Hamilton Township School District, Department of Curriculum and Instruction, held an inservice program to acquaint elementary and middle-school teachers with activities, teaching methods, materials, classroom structure, and behavior that might be a cause of math anxiety for students. After establishing the premise, she provided the participants with ways to evaluate for bias and to overcome it. Fourteen teachers, 13 females and one male in grades 4 to 8 attended the after-school workshop, at which Dr. Susan Marchand, Assistant Professor of Mathematics/Computer Science at Kean College, Union, N.J., presented materials and resources on the problem. A memorandum was then sent to the teachers suggesting a few activities they could conduct with their classes and asking them to report back on the activities and results. (See memorandum, Appendix III-B.) Having teachers carry out projects and report back is an excellent method of ensuring that classroom activities result from the training session.

Below are some of the activities that the teachers reported:

- Class discussion of student feelings about mathematics, parental beliefs about math, the parent that students seek for help in math, students' plans concerning enrollment in math courses;

- Evaluation of textbooks for sex bias;
- Student creation of word problems to be analyzed later for male/female roles;
- Tangrams as a spatial relations exercise.

Here are some of the project descriptions and results:

- In a learning center for grades 6-8, where Tangrams were offered, more boys than girls chose them. The teacher found that those children who had played with Tinkertoys, Leggos, Lincoln Logs and/or metal Erector Sets were more proficient with Tangrams than those who had not. Girls could work with Tangrams as successfully as boys; they often had wide experience in the manipulative toys listed above;
- When students surveyed their 5th and 6th grade math texts for sexism, they found them to be sex fair;
- When students were asked to create word problems using a boy's or a girl's name and an occupation, the teacher found that although each sex tended to create stories about his/her own sex, boys were mentioned more frequently than girls. Here are the results:

	WORD PROBLEMS		
Writer	about girls	about boys	about other (including animals)
6th Grade Boys	25	75	82
6th Grade Girls	62	27	25
6th Grade Totals	87	102	107
8th Grade Boys	2	35	
8th Grade Girls	30	11	
8th Grade Totals	32	46	

- When students in a low-math 4th grade group were asked to write word problems using a child's name and identifying a job, girls named males as carpenter, dogcatcher, state worker, shop owner, and doctor; while females were named as teacher, babysitter, clerk, secretary, barmaid, maid, nurse, and homemaker. Boys named males as auditor, builder, steel worker, state worker, gas station attendant, television watcher; they named girls as dishwasher, teacher, and clerk. Again girls named boys more than boys named girls; both groups saw each sex in stereotyped jobs, with males especially viewing women in limited roles.

- In a gifted and talented 6th and 7th grade group, six of eleven students said they went to their fathers for math aid; only two asked their mothers for help, and others received aid from siblings. All four of the boys but only four of seven girls intended to take future math.

- Interestingly, when the teacher asked a 5th grade group about their attitude toward math and their future plans, seven of eight girls liked math and intended to take it throughout high school. Only four of fourteen boys liked math, but nine intended to continue their studies.

- Two projects involved creating new math units which were presented in a nonstereotypical fashion:

    a) Consumer Unit: student developed a real-life setting of a store in which both girls and boys were clerks and cashiers; all students had to do accounts;

    b) Metric Unit: students used devices to measure meters, liters, and grams. Then they made cookies using metric measuring utensils.

    c) Film Unit: showing films on careers led to a student discussion of the roles shown in the films;

    d) Geometry Unit: two- and three-dimensional structures were used by both boys and girls.

Ms. Mooney reported that the project will be on-going: other workshops and meetings will be held. Many of the original volunteers had a special interest in math anxiety; other teachers need to be reached. Also time was too short for many lengthy activities to be carried out. Because a number of the teachers indicated that they had planned other activities, Ms. Mooney intends both to reinforce the initial participants' attitudes and activities and to conduct similar workshops to inform all teachers of what can be done to remedy math anxiety.

Suggestions

Rather than open ended reporting sheets, which are difficult to tally and coordinate, a specific format for reports would be useful. Sufficient time, perhaps as much as three to four weeks, between the workshop and the report-date for results should be provided; the teachers could then try more than one activity. More than one group meeting to share and discuss the results, projects, and follow-up activities, would be beneficial.

Developing Sex-Fair Materials and Career Counseling

Theresa Farinella of South Brunswick High School, introduced a sex bias component to teachers in a project already under way in the district. This project provided staff with the opportunity to familiarize themselves with careers through a cooperative work program in local businesses and industries. Ms. Farinella's goal was to show teachers why they should use sex-fair materials both in the classroom and in counseling, and how to develop new lesson plans.

The activities included:

- Showing three filmstrips: A Woman's Place, which describes the images and myths about women and the new women's rights movement; Sexism in Schools: What We Can Do, an introduction to sexism in education and some techniques to overcome it; and Help Wanted, which describes sex bias in career education materials (see Bibliography-Teacher Resources for further information on the filmstrips).
- Presentation of an article on the problems of lack of self-confidence often found in women;
- Presentation of a textbook evaluation form developed within the district.

All of the activities led to discussion and then to the introduction of sex-fair lesson plans, including counseling activities.

Parents' Education in Sex Bias and Science

Herbert S. Herman of Bronx (N.Y.) Community School District 10, used a Parent's Association meeting to alert parents to possible loss of intellectual potential in children because of sex bias in textbooks, teaching materials, and teacher attitudes, especially regarding mathematics and science. Sixtytwo members (61 females and one male), of the Parent's Association of P.S. 46, Bronx Community District 10, as well as a president of another Parent's Association participated.

Free To Be...You and Me, a filmstrip, introduced a general discussion on sexism and affirmative action. Dr. Sheldon Lindenbaum, Community Relations Coordinator, District 10, led this segment of the evening's events. Next, Mr. Herman, District Science Coordinator, discussed what parents can do to raise the aspirations of children, especially those of their daughters. Parents were asked to help their children to overcome stereotypical behavior by encouraging participation and achievement in math and science.

One activity in which parents participated at home with their daughters to further this end was to create styrofoam plastic jet gliders from discarded meat trays. (For examples of possible plans for making the gliders, see Appendix III-C.) Only a handful of women had ever made a model of any kind because this activity usually is reserved for boys. Although the meeting lasted almost two hours, many of the parents wished to continue the discussion. The group's president agreed to continue it at another meeting, and he asked the resource person to return.

Because this workshop answered a felt need, plans are under way to develop similar discussion groups in all of the district's schools. This project is an excellent example of cooperation among teachers, administrators, and parents, and of how to increase parents' awareness and enlist their aid in the work needed to achieve sex equity.

Career Possibilities and Parent Awareness of the Need for Math

Parent Back-to-School Night at Paramus High School aimed at increasing female enrollment in math courses. To expand parent awareness about careers that require the use of math, Daniel T. Jankelunas prepared a display: he put a list of the mathematics courses offered at Paramus High School beside booklets about the high school math that many careers require, and he set up a table of free materials on careers in math and science, (see Bibliography). Dr. Eileen L. Poiani, Director of Women and Mathematics (WAM) a project sponsored by the Mathematical Association of America, spoke to interested parents.

Although those parents who stopped at the display were quite interested, few did so. Attendance for the entire program was poor, and most parents were not concerned about careers on that particular evening.

Suggestions

This format would be excellent for a Career Fair or Career Night or an assembly on mathematics and careers. Bulletin boards that display the same information could be put up in the school's corridors. If such a display were placed near the front door, it could also be seen by parents and other visitors.

CHAPTER IV

WORD PROBLEMS AND SPATIAL RELATIONSHIPS

Dr. Marcia Horn
Highland Park School District

Sharon Lynch
Metuchen School District

Christine Kline
South Orange/Maplewood School District

Increasing Achievement in Solving Word Problems Through Use of Sex-Fair, Pupil-Made Materials

Dr. Marcia Horn's project on word problems focused on 19 children in a combined 2nd and 3rd grade class. Her objectives were:

- To improve student achievement in solving word problems;
- To improve children's attitudes toward word problems;
- To determine whether student achievement in solving word problems, traditionally low, was related to the sex-stereotyped content of word problems in textbooks;
- To create pupil-made teaching materials.

Activities: Children were given a pretest consisting of ten word problems taken from Scott Foresman's Seeing Through Arithmetic: Book 3 (Third Grade, 1966 edition). The situations depicted were highly sex-stereotyped; the scores were generally low, averaging 68.7 percent correct answers.

The class discussed these problems and decided that textbook word problems generally show boys doing "boy things" and girls doing "girl things" and that neither reflects what real boys and girls do. Then Dr. Horn assigned the following homework: "Think of a situation that really happened to you that in some way involved numbers. Write it down just as it happened and bring it back to class."

During the next week, the children read their problems to each other and discussed how to solve each one. All alternative solutions were explored, and equations to solve each were set up. Because the emphasis was on the process, not all of the problems were worked out to solution. Student interest was high. A brief five-problem test from the text was given a week later to see if the lessons on how to solve word problems had resulted in an improved ability to cope with these sex-stereotyped and unrealistic problems. However, pupils disliked the assignment and scored even lower than on the pretest, averaging 50.6 percent correct answers.

Children again created word problems in class and wrote the solution on the back of the sheet. They then traded papers with classmates, worked out the problems, and checked to see if their answers matched those on the back. Most did, and all enjoyed the activity.

After the children had copied and illustrated their problems, at least one of each child's problems was put on a ditto master. Then the children worked in groups to assemble and collate these pages into a workbook. One announced, "This is just like a factory!" They had invented an assembly line. The final activity was that each child received a copy of the workbook and tried to solve each problem, showing all the work. Individual solutions could be checked with answers, which were printed upside down at the bottom of the page.

The workbook problems were listed by sex of the writer, problem type, and situation. Most children wrote in the first-person, which involved the problem-solver with the problem. Each child identified with the "I" problems. Here are some of the student-created problems:

1. I read five books and then four more. How many did I read in all?

2. I went to the store. I had 10¢. I bought three pieces of carmel. Each cost 3¢. How much change did I get back?

3. There were 15 girls playing kickball. Then 17 boys came and wanted to play. How many all together?

4. When I was in Ireland I was in a car crash. There were five people in the crash. Then three grownups came to help. How many people in all?

5. Yesterday I saw a Rutgers game. The score was 24 for Rutgers and 17 for the other team. By how many points was Rutgers ahead?

6. I had 10¢. I went to a store. I bought gum. Each piece cost 3¢. How many pieces of gum could I get?

7. Jimmy and John and I won 30 pieces of candy. We divided it. How many pieces did each of us get?

8. I had 10 pieces of candy. I left them on my bed. My brother came and took 3. How many do I have left?

9. For my birthday I had 20 guests. Each one gave me two presents. How many presents did I have altogether?

10. Once I wanted to figure out something with hours and days. I know there are 7 days in a week and 24 hours in one day. So how many hours in a week?

When the workbook problems were used as a posttest, the scores averaged 85.3 percent, a dramatic improvement over the pretest average of 68.9 percent. The children had improved their word-problem skills, and in a spirited, cooperative manner. Only two children scored lower on the workbook posttest than on the pretest, while nine had posttest scores 20 percent or more higher than their pretest scores.

When Dr. Horn analyzed the incorrect responses to each problem by sex, she found that, with one possible exception, neither girls nor boys made a significantly greater number of errors. The six problems most often incorrectly answered were the most difficult, usually because they involved more than one operation. Only one problem seemed to have a sex-related difficulty -- more boys than girls answered incorrectly a problem that dealt with the exchange of one dress for another and the payment of a price differential.

Dr. Horn also noticed that two girls, one a bright but extremely math-anxious second grader, and another, a math-avoiding third grader, were excited by the project and at the opportunity to write word problems about themselves. Each produced more than the two required problems. The third graders' problems posed some especially interesting situations: she shared baseball cards with another girl and boy; she flipped baseball cards and won many from a boy; a group of girls played kickball, but allowed some boys to join them. It is possible that her math avoidance was related to the exclusion of girls from active sports in textbooks and from an inability to identify with those female activities which were depicted. The math-anxious second grader might have felt more comfortable working with familiar situations involving math. She scored 100 percent on the workbook posttest, a jump of over 20 percent. Of all the children, one second grade girl showed the most originality in working with the problems. Her parents and teachers were alerted to that fact. (For the workbook, see Appendix IV-A.)

Suggestions

Although handwriting is not usually taught in math class, if the project is replicated, some time practicing legibility and neatness is advisable. In some cases, the children need help in reading a classmate's handwriting. Also, some second graders are unable to read cursive writing, therefore it would be wise to ask everyone to print. Among the problems with the most incorrect responses, there were several involving two separate calculations. It would be advisable to hold these for a later class-produced workbook or to provide some instruction in solving multipart problems.

Sex Roles in Student Word Problems: Middle School Unit

To find out students' attitudes toward sex roles, Sharon Lynch of Metuchen School District, used a word problem assignment in her 7th grade math/science classroom. The class, consisting of 26 girls and 22 boys, were asked to create word problems using situations and people in a lab experience, utilizing students and the following:

1) Metric distances;
2) Force measures, carts and inclined planes;
3) Calculating work (work = force X distance, for example).

Example using metric distance:

The cheerleaders and the football team wanted to measure the length of the football field using metric units. The football team wanted to use the easiest method. What would they choose and why?

Of the 96 problems that met the criteria, 71 contained male characters, while only 25 contained females. The following list shows the activities used and the gender of the people mentioned.

ACTIVITY	M	F
MEASURING LIVING ROOM	2	2
LIFTING SINKERS	2	2
MEASURING SEE-SAW DISTANCE	4	
LIFTING HEAVY OBJECT	9	
BALANCING A ROD	1	
METRIC CONVERSIONS	4	
PUSHING CART ON INCLINE	5	2
LOADING CARGO ONTO TRUCK	7	1
RUNNING A MILE	2	3
MEASURING BOWLING ALLEY	1	
PULLING A WAGON	1	
ENTERING A POSTER CONTEST		1
WALKING A DISTANCE	1	1
MEASURING AIRPLANE RUNWAY	1	
MEASURING DRAG STRIP	1	
MEASURING BASEBALL FIELD	3	
GANGSTER SHOOTING GUN	1	
MEASURING A BED	1	
CARRYING A HEAVY OBJECT	1	
MEASURING A CITY BLOCK	2	
LAB EXPERIMENT	1	1
MEASURING A CLASSROOM	1	
	51	13

ACTIVITY	M	F
MEASURING A HAT SIZE		1
PUSHING A BOX OF DOLL CLOTHES		1
MOVING A DOLL AND CARRIAGE		1
LIFTING A BLOCK		1
CARRYING BOOKS	1	
MEASURING DISTANCE TO SCHOOL	2	
MEASURING LENGTH OF GARAGE	2	
MOVING A HOUSE	2	
SWIMMING	1	2
BROAD-JUMPING	1	
THROWING A FRISBEE	1	
THROWING A SHOT-PUT	1	
PULLING A BALE OF HAY	1	
MEASURING HEIGHT, LENGTH	1	1
MEASURING A BASKETBALL NET	1	
MEASURING A STAGE		1
WHEELBARROW RACE	1	
CARRYING BRICKS	1	1
JUMPING	1	
MEASURING DIAMETER OF RECORD		1
BICYCLE RACE	1	1
PUTTING THINGS ON A SHELF	1	
MEASURING CONTAINER FOR ANIMAL	1	
	20	12

When the problems were discussed in class, the students were surprised at the results. The project awakened them to sex-stereotyping, and even spurred some of the higher-achieving female students to consider careers in science.

The survey also showed the degree of sex bias in 7th grade students. Although there were more females than males in the class, the activities described were overwhelmingly male-oriented. All students depicted males in exciting, creative activities, while the females were involved in far less creative chores, as the list shows. One conclusion is that although such projects are useful in improving students' attitudes toward women in math and science, they must begin earlier than the 7th grade.

Suggestions
It would be less confusing if the students were given only one topic on which to create problems.

Building Structures: A Team Approach to Spatial Relationships

Christine Kline of South Orange/Maplewood School District designed a structures unit for second graders. The success of this project depended on two factors: teamwork in mixed gender groups, and problem-solving abilities so as to be able to proceed with the task of constructing a specific structure. At the beginning of the school year, Ms. Kline had initiated discussions on "People are People", their differences and similarities, and how, though each person is unique, people work together, play together, and share together. Mixed groups of 4-5 boys and girls with a leader designated by the teacher were assigned tasks which had to be accomplished in a cooperative way. Although early on there was some resistance to girls as group leaders and to "boy-girl" pairs, by November group interaction had become natural and relaxed without reference to the sex of the leader or of the pairs. To encourage leadership abilities in the quieter and more passive children (including a fair proportion of girls), Ms. Kline assigned very specific tasks to these leaders and took each one aside and reviewed with them what had to be done. The leaders were then able to master those tasks and proceed with confidence.

Once the children accepted this cooperative framework, they proceeded to apply their group work and cooperative problem-solving experiences to creating free-standing structures.

Materials provided were newspaper, oaktag strips, straws, toothpicks, pipe cleaners, and dowels. The children used tape, staples, clay, and string as fasteners. They invented structures, and, starting with a triangle as a basal unit, succeeded in constructing a dome and tetrahedrons. They discussed what worked and what did not work, and learned to learn from their failures. They brainstormed and learned to use strengthening techniques to make their structures free-standing: such as folding oaktag strips length-ways and rolling newspapers; using beams, columns, buttresses (even flying buttresses!) and foundations. (See Appendix IV-B for diagrams of the structures.) The structures included geodesic domes (using rolled newspaper and oaktag discs); a cricket cage (using pipe cleaners); sculptures; mobiles; buildings (using toothpicks and clay); and a variety of other buildings (using oaktag strips and tape).

A male architect and carpenter and a female engineer visited the class and provided examples of the application of structural techniques to real buildings. A visit to a construction site to see a building in progress was arranged.

The children became very enthusiastic about this structures unit which provided involvement for all the children, developed leadership skills, integrated girls and boys in cooperative group work, and provided hands-on experience with spatial relationships - a crucial area to the development of mathematical skills.

Suggestions

This unit could be expanded to include art, architecture, social studies and science: sculptures for sheer beauty to be found in structures; the organization of a model community and designing buildings for it; the variety of designs for buildings in different geographical regions and climates; the exploration of natural structures, such as plants, animals and animal habitats. An excellent resource for this unit is Science 5/13: Structures and Forces, Stages 1 and 2 published for the Schools Council by Macdonald Educational, London, U.K. Women architects and carpenters would provide role models in nontraditional jobs for the children.

CHAPTER V

CAREERS AND SCIENCE

Louise Mehle
Union School District

Paul Desmond
Eatontown School District

George Howard
South Orange/Maplewood School District

Linda Petruzzello
Passaic County Vocational and Technical High School

Too often, career planning is delayed until the student is forced to choose a program in high school. Research confirms what the reader knows: while boys who are asked what they want to be when they grow up do not respond "a father," a large proportion of girls will still say "a mother." Our society does not yet actively enough encourage a career orientation for girls, even in the face of recent statistics on women in the work force.

In June 1978, with over 43 million women in the labor force, the participation rate of women 16 years old and over exceeded 50 percent for the first time in history. Recent projections from the Bureau of Labor Statistics now predict a participation rate that may reach 60 percent by 1990. Ninety percent of all women work at some time in their lives. The average young woman of today can expect to work for more than 25 years. Even young women with children are in the work force today (more than half of all mothers with children under 18 and 41 percent of mothers with children under 6 years of age). This is a far cry from the traditional stereotyped family image in which most Americans still believe.

It is essential that school personnel provide experiences and an environment in which both boys and girls develop their capacities to plan for their future careers. For example, counselors should guard against dealing only with entry-level positions when they indicate how much math is necessary for certain fields (even the guidelines of the Mathematical Association of American are guilty of this). In most instances, more math is required in higher-level jobs, especially in this age of computers, increased technology, and complexity of industry and society. Many students, especially females, do not learn enough advanced math to qualify for higher level jobs.

Integration of Math/Science in Technology for Children (T4C) Program

Teaching math and science should not be dull, nor should it seem irrelevant to everyday concerns, especially in elementary school, when interests are sparked and ideas stored away for future reference. A particularly useful way to provide successful experiences and to motivate younger students is to organize a hands-on project. Louise Mehle, in her third grade class in Union School District, applied the Technology for Children program to the subject matter of math and science. T4C is a hands-on program sponsored and co-funded by the Division of Vocactional Education, New Jersey Department of Education, and by the Ford Foundation, to make industry and technology relevant to elementary school children. Its goal is to teach the scientific method of observation and experimentation through the application of these skills to the mastery of the physical world. In T4C, the children work with materials (such as wood and leather) and equipment (such as saws and drills). As they progress, the children develop competencies with these tools and increase their mental and physical coordination.

Using T4C activities to reinforce math and science learning helps children to utilize and apply their knowledge of the subject area in a practical, relevant manner. Further, if both girls and boys use technology at an early age, they will develop their abilities to explore, question, and experiment, which as they mature, may lead to increased interest and ability in scientific and technical fields. As girls participate in technological activities, they will realize that they can analyze problems, seek solutions, and make contributions equal to male students. Incidentally, at a meeting of women scientists in 1977, one conclusion was to recommend that women take courses in industrial arts to become familiar with the tools often used in science.

Ms. Mehle's T4C math activity was the construction of a geoboard, since the children were learning about geometric figures and perimeters. Each child constructed a large square out of wood and then hammered on it nails that were one-inch apart. Each child then made various figures and measured them by entwining colored rubber bands on the nails.

The scientific T4C activity coincided with a unit on the stars and constellations. First, each child cut an octagonal figure out of wood. After they had painted them and drawn a constellation on one side, they placed white buttons where each star in the constellation is situated; they then typed the story of that constellation and glued it to the back of the octagon.

This class also completed a unit on careers in which they chose to investigate and prepare group reports on the following careers: scientist, mathematician, chemist, anatomist, astronomer, ecologist, oceanographer, veterinarian, forester, engineer, botanist, and zoologist. The discussion of careers stressed that these areas are open to girls, as well as to boys, and underlined the need for a good background in math and science. In the groups the career goals of the boys and girls were similiar. All assumed that they could pursue any area they desired as long as they went to college.

Sex Role Stereotyping in Grades 3 and 6

In a further effort to find the stage at which it would be most beneficial to introduce intervention techniques to correct previous imbalances, Paul Desmond of Eatontown School District compared 180 3rd and 6th graders.

First, a questionnaire listing 18 job titles was distributed to 28 boys and 27 girls in grade 3, and to 45 girls and 57 boys in grade six. (Two of the job titles, "religious person" and "a person you can trust" cannot be considered bona fide occupations.) Students checked each job title according to which sex they believed would be most likely to hold that job. (See Appendix V-A for a copy of the questionnaire and the tabulated results.)

After a series of classes about sex discrimination, the students were asked to complete it again. Then, the before and after scores were compared.

Among the 3rd graders, four of the traditionally female jobs (secretary, nurse, artist, cook) showed a less traditionally female score after class instruction about sex discrimination. The decreases were as small as 1 percent and as great as 11 percent. However, 90 percent or more indicated that secretary, nurse, and airline attendant would be a female. In the first survey, for example, only 4 percent of the 3rd graders thought females were likely to own a business; letter carrier, agent and professor were male-dominated jobs. After class discussion of sex discrimination, 36 percent of the students felt females would be likely to own a business; and job titles showing a higher percentage of females in that occupation included letter carrier, agent, and teacher (but not professor!)

The smallest growth was in the category of professor. A change of only 2 percent was noted, and it is interesting to note that with the progress from teacher to high school teacher to professor, the likelihood of the employment of females in these positions steadily declines, from 57 percent to 46 percent to 22 percent.

The third graders' attitudes were somewhat changed, even by this one, small experience in new career options, which again shows how important such work is.

Varying degrees of change were recorded by the sixth graders. Three jobs were seen as almost always held by a female: secretary, nurse, and airline attendant; thus sixth graders stereotyped less than third graders did. After class discussions, the percentage of the positions likely to be held by a female increased in thirteen of the eighteen jobs listed. The biggest increase was evidenced in the careers of letter carrier and athlete: females gained 15 percent over the first poll. The most stereotyped male jobs were letter carrier, professor, business owner, and athlete (over 80 percent). The posttest revealed that letter carrier, business owner, and professor were still seen primarily as male jobs. The results of the sixth graders concerning the teaching profession were similiar to third graders: teacher 48 percent female; high school teacher 37 percent; professor 7 percent. There was less change in the sixth grade scores after class lessons indicating that older children's ideas are more strongly fixed. Although females were seen in broader ranges of career options, sixth grade students were not as susceptible to change from a few lessons as the third graders were.

Suggestions

It would be informative to separate forms by sex and to compare female and male scores. Also on the occupational listing, more occupations of interest to the students might be included, especially those requiring math/science backgrounds.

Nontraditional Careers: A 5th Grade Media Project

An exciting unit for a team-taught 5th grade class, developed by George O. Howard, South Orange/Maplewood School District, involved not only the students but encompassed others in the schools and community. Women in nontraditional careers were invited to visit the class, talk about their jobs, and serve as role models. The speakers represented a wide variety of fields, including chemistry, mathematics, marine biology, engineering, and veterinary science. (For the roster of speakers, see Appendix V-B.)

Prior to each guest's arrival, the fifth graders investigated the particular career and planned questions to ask in a press conference-style interview after the speaker's presentation. Each session was videotaped by junior high students and CETA personnel. Teachers and administrators were involved in scheduling and coordinating activities. Since the tapes were aired on local cable television, the community too, was given an opportunity to see women in nontraditional careers. Thus this project fostered excellent school-parent-community relations.

Vocational Students' Attitudes Toward Sex Stereotyping

Linda Petruzzello of Passaic County Technical and Vocational High School worked with 22 ninth graders in her math class to increase awareness of sex-stereotyping in job opportunities through a series of four weekly workshops. The goal was to influence the students' decisions about their shop major, scheduled to be chosen soon after the end of the sessions.

The first workshop focused on sexism and language, a topic on which the teacher found high student awareness (see Appendix V-C for a copy of the quiz on sexist language). She also showed a film, Changing Images (see Bibliography for a description).

At the second workshop, the students learned about sex-stereotyping in jobs. They were divided into four groups: two all-male and two all-female. The male groups were asked to list jobs women could not do, and the female groups, jobs that men could not do. Their lists, which follow, were put on the blackboard and discussed.

JOBS WOMEN CAN'T DO

COAL MINER
BOXER
BRAIN SURGEON
PRO FOOTBALL
PRO HOCKEY
GARBAGE COLLECTOR
HIGH STEEL CONSTRUCTION WORKER
SHIP CAPTAIN
POPE
PIMP
RAPIST
BOUNCER
U.S. PRESIDENT

JOBS MEN CAN'T DO

HAVE BABIES
AVON LADY
LIVE WITHOUT WOMEN
HOUSEWIFE
RECEPTIONIST
MIDWIFE
TELEPHONE OPERATOR

The discussion led to the decision that no job listed was impossible for either sex. (A boy even insisted that having babies was possible for men since the movie, Rabbit Test!)

The third workshop focused on instances of sex discrimination in the schools. The class was divided into three groups, each of which worked on a different situation. Each group was to try to solve the problem and prepare a skit showing its solutions. The situations were as follows:

1. Jane Arnold is in Mr. Wilson's chemistry class. During lab time, students must work as partners on the experiments. Mr. Wilson will allow only boys to handle the chemicals and equipment in the lab. Female partners may only watch the experiments and take notes. Jane is interested in becoming a lab technician and wants to perform some experiments.

   What should she do?

2. Arlene is interested in becoming an auto mechanic. Mr. Johnson, the auto teacher, does not want girls in his shop. He says the work is too heavy for them and, besides, no one will hire a woman mechanic.

   What can Arlene do?

3. Jean is interested in joining the Football Club, but finds out it's for boys only.

   What can Jean do?

Some student conclusions were:

-- The guidance counselor threatened to fire the teacher if he did not change;

-- There seemed to be no solution for the second problem;

-- The athletic director threatened to withhold equipment from the Football Club is the boys wouldn't let Jane play;

-- Boys were more reluctant role players in the skits;

-- Girls tended to choose the powerful roles to play.

At the final workshop the students indicated their shop choices and evaluated the workshop series. Student evaluations were overwhelmingly positive. They wholeheartedly agreed that they had become more aware of sexism and that it would be worthwhile to present these workshops next year. Regarding shop majors, four out of 12 females chose shops that were nontraditional for their sex, while none of the ten males did.

Suggestions

Preparation of a complete evaluation form would enhance this project, as would a pretest of knowledge, viewpoints, and shop major. Because there was no pretest, it could not be determined if any students changed their choice of shop major. The shop choices did indicate that more females than males are interested in nontraditional careers at this age, a conclusion that other research supports. Most studies of adolescence show that females, far more than males, are influenced by changing social roles; while males continue to evidence traditional viewpoints.

CHAPTER VI

LIBRARY ASSIGNMENTS AND ROLE MODELS

Diane Brzezienski
Bedminster School District

Gervase Castner
Paramus School District

Walter H. Tylicki
Linden School District

Joseph Knight
Pompton Lakes School District

Joyce A. Kirchin
Clinton School District

Until recently, female math/science role models have been few and far between. Whoever heard of an important female scientist? Since none were mentioned in texts, the likely conclusion was that none exist, except for Marie Curie. Of course, it is often assumed that she was more of a helpmate to her husband than an independent researcher! Although most scientists and mathematicians have had a course in the history of mathematics or science, they have never learned of women's achievements in these fields. It is, therefore, surprising to find that there were achieving women in mathematics and science. (See the lists and examples of biographies in this chapter and in the Bibliography.) In order to provide students with this data, the inclusion of research assignments on women scientists and mathematicians can complement texts which so often do not display any recognition of women's roles in the sciences.

While it is important that students know that women have been achievers in the world of science in the past, it is even better for students to see and meet with today's women scientists. It is difficult to identify with someone as remote as Hypatia, Curie, or Meitner, not just because of time or distance, but because of their extraordinary achievements. We should, therefore, provide living, working women scientists and mathematicians, role models with whom girls can identify. Visits to nearby industrial, research, and educational institutions to meet scientists, as well as visits by scientists to the school, can provide students with a realization that women have a place in the scientific technological world of today.

As a beginning, a number of projects, both national and local, which have already been developed, can be useful in assisting school personnel in their search for role models. For a list of New Jersey women in nontraditional occupations willing to speak to school groups, a booklet entitled Directory of People in Nontraditional Jobs (see Bibliography) has been issued by the Office of Equal Access, New Jersey Division of Vocational Education, Trenton, NJ. Edited by the Training Institute librarian, Marylin Hulme, it provides easy access to women in science and technology. School district personnel also might want to use this as a prototype and create their own lists of local women scientists.

Women and Mathematics (WAM), sponsored by the Mathematical Association of America, began in 1975 to provide women lecturers to encourage 10th graders to enroll in advanced mathematics. A nationwide organization including the New Jersey, New York, and Connecticut Region, its speakers emphasize the necessity of a strong math background for entry into virtually every major career field, and they highlight female achievement - past and present - in various fields such as opthalmology, accounting, computer science and statistics, medicine, physics, urban planning, college teaching, research biology, engineering, and business management.

For further information about scheduling a speaker: in New Jersey or New York, contact Dr. Carole Lacampagne, Bergen Community College, 400 Paramus Road, Paramus, NJ 07652, or, Dr. Susan Marchand, Kean College, Union, NJ 07083; in Connecticut or Westchester County, New York, contact Ms. Margaret Pryor, 39 Robert Lane, Wappinger Falls, NY 12590. On the west coast, the Math/Science Network, an association of individuals and organizations whose goal is to promote the entrance and participation of women in mathematics and science has been established. Members are scientists, educators, engineers, parents, community leaders, business and industry people. For more information, contact Ms. Joanne Koltnow, Math/Science Resource Center, Mills College, Oakland, CA 94613. In North Carolina, contact the Visting Women Scientists Program, Research Triangle Park, NC 27709.

Women of Achievement: An Elementary Unit

To encourage elementary students to consider divergent career possibilities, Diane Brzezienski, Bedminster School District, created for her 17 3rd and 4th graders a library assignment on mathematicians and scientists. After she had researched the library's resources that could be read by her students, she assigned the following activities:

- Read about a female mathematician or scientist;
- Find out how these people become achievers;
- Draw pictures of their discoveries;
- Share information orally with the class;
- Write down the facts each student learned from others.

To broaden the survey's scope, filmstrips were shown, tapes played, and two speakers, an environmentalist and an astronaut, visited the class.

Using their reading notes, the students culminated the unit with the creation of a booklet, which was exhibited at the school science fair. The children enjoyed finding information and sharing it; they especially liked having guest speakers. This project could be adapted to upper grade levels, where more information is available. Additionally, more guest speakers could be invited, or visits to local industry could be arranged.

This project has ramifications, especially in career awareness; interest in nontraditional and new careers is sparked early in children's lives. Ms. Brzezienski noted an increased interest in science and much discussion was generated by the information. Because she believes a similar project in math might have the same effect, she is now developing a parallel unit.

Biographical Unit for the High School

In a project on women in science, Walter H. Tylicki of Linden High School involved students, teachers, and librarians. His objective was to show students that women have been and can be prominent in math and science careers. A library assignment on Women in Mathematics was developed for use by approximately 200 10th grade mathematics students (see Appendix VI-A for a copy of the assignment sheet). For some students the project was mandatory, while for other others it was voluntary. The assignment required each student to write a report on women's contributions to mathematics; the assignment sheet listed 25 women who contributed to the history of mathematics and provided suggestions on how and where to find information. Both the school and public librarians were alerted to this assignment so they could identify and reserve useful materials. Books were also ordered to fill in the large gaps in the collections.

Particularly important to the success of this project was the prior coordination with the librarians; otherwise one might experience another project sponsor's problem: irate phone calls from librarians who were bombarded with requests for materials on women in science which they could not fill. If handled well, this project can become a consciousness raiser for other staff and librarians in addition to the students.

Suggestions

Because math does not often contain reports and projects as an integral part of the curriculum, this activity contributed greatly to the mathematics program. However, since so many students were involved, it probably would have been more effective to provide several alternatives to the biographical project. A better strategy would have been a wider library assignment with a greater variety of topics and materials.

Library Assignments and Resource Evaluation: 12th Grade Science

Use of library resources and evaluation of science texts were part of a project conducted by Gervase Castner of Paramus School District. The students were given a choice of projects. Of the 14 male and female students in the 12th grade class, ten chose to do biographies of women mathematicians and scientists, three examined textbooks (physics and biology), and one reviewed a science film. A bulletin board decorated the room.

Some examples of the completed projects were:

- To observe how women face discrimination in science, one student counted numbers of males and females found in the pictures of the Helena Curtis Biology Book (Worth Publishing Co.). Her results were: 42 pictures of males "are of great scientists; the five pictures of women are of nothing but degrading pictures of domestic house workers, frolicking, giddy women, and observers, not participating women." She concluded: "There isn't one picture of a woman scientist contributing to the field of science. Therefore, inclusion I feel of the Biology book, written by a woman (no less) is very biased against advertising the great women in science and their contributions."

- In an evaluation of a film, Myoglobin (Harper & Row Publishers), the student found that all people who made the film were male, "Comments: No females or male minorities in this production."

Biographies were written of the following women:

MARIE CURIE, PHYSICIST AND CHEMIST
HYPATIA, MATHEMATICIAN AND PHILOSOPHER
LISE MEITNER, PHYSICIST
CAROLINE HERSCHEL, ASTRONOMER
GERTY CORI, BIOCHEMIST
RACHEL CARSON, BIOLOGIST
EMMY NOETHER, MATHEMATICIAN
MARIA GAETANA AGNESI, MATHEMATICIAN AND PHILOSOPHER
ELIZABETH BLACKWELL, PHYSICIAN
ELIZABETH KENNY, NURSE
MARGARET MEAD, ANTHROPOLOGIST
MARIA MITCHELL, ASTRONOMER

Suggestions

Before starting a similar project, the teacher should cooperate with school and public librarians to ensure that materials on women in science are available.

Science is not Magic

In order to acquaint students with women who are capable scientists, Joseph Knight of Pompton Lakes School District invited Joan Scowcraft of N.J. Bell Telephone to present a program to all 8th graders. Students enjoyed the presentation entitled: "Science Is Not Magic." In addition, students were given assignments in which emphasis was on reading and learning about famous women scientists and their contributions. Discussions were held daily, with emphasis on newsworthy items. Finally, Mr. Knight developed a display in the school library, "Famous Women in Science."

Role Modeling (Including Students' Parents) in Science

Joyce Kirchin of the Clinton School District developed a series of activities to introduce her 7th grade students to nontraditional careers. One hundred three students were asked about their parents' occupations. Of the three fathers who worked part-time, none stayed home to look after the family, nor was anyone in a nontraditional occupation. Of the approximately 60 percent of the mothers who worked part- or full-time, only two held nontraditional jobs.

The two mothers, an architect and a toxicologist, were contacted and invited to speak about their experiences. Since so few parents with nontraditional careers had been identified, Kirchin invited other women in nontraditional careers: engineer, dentist, opthalmologist, gynecologist-obstetrician, tennis pro, psychologist, and one male, a nurse. Guests spoke about their occupations, educational requirements, and their experiences as workers in nontraditional fields. A question and answer period followed.

Ms. Kirchin also decorated the room with posters showing women in science-related occupations. As an attention-getter, a large Women in Science logo was placed in the middle of the room. Anyone who could identify it won a prize.

Participation in the Women in Science program was on a voluntary basis, and 23 female and male students signed up for the program. Classes and informal chat sessions were held at least twice a week. As an assignment, students were asked to study a historical woman in science, or a woman working as a scientist in the community, then use the information to create a recruiting poster to interest more women in scientific careers. (For the assignment sheet, see Appendix VI-B.) Each student was given a reading list, Notable Women of Science (Kalamazoo Public Schools). (See Appendix VI-C.) As an on-going activity, each student participated in the making of Women in Science, a slide-tape presentation (see Appendix VI-D for the list of women scientists included).

Students were excited about the activities. Some speakers stayed two hours because the children questioned them and discussed their feelings toward sex discrimination. All students became more sensitive to "hidden" female discrimination in school.

Suggestions

Although Ms. Kirchin's questionnaire did not uncover many nontraditional job holders, such a questionnaire might be distributed to the entire school. The results could be used to begin a school directory of resource persons in nontraditional careers.

BIBLIOGRAPHY

The purpose of this bibliography is to provide access to supplementary materials for use in classrooms and school media centers. Included are books, filmstrips and career pamphlets to enhance and assist in the implementation of the projects described in this volume. The bibliography is divided into five parts: Grades K-6; Grades 7-12; Career Pamphlets; Teacher Resources and Programs. With the exception of those items marked with an asterisk (*), all materials listed are available in the Resource Center of the Training Institute for Sex Desegregation, and may be consulted or borrowed.

Marylin A. Hulme

Grades K-6

A.S.M.D. ARITHMETIC PRACTICE & DRILL SHEETS, GRADES 1-8. Valerie E. Mock. Belmont, CA., Fearon, 1977. 360 p. illus. pap. $9.95.
Collection of worksheet masters designed to support basic classroom text; word problems are nonsexist.

ANIMAL FATHERS. Russell Freedman. New York, Holiday House, 1976. 32 p. illus. hard. $4.95.
Pictures and short descriptions of males who care for their young.

ASTRONOMY: EXAMINING YOUR ENVIRONMENT. John C. MacBean and others. Toronto, Holt Rinehart and Winston, 1973. 96 p. illus, index, bibliog. pap.
Well illustrated book for elementary school children with activities to develop skills and learn about astronomy and our place in the universe.

BATS. Valerie Pitt. London, Franklin Watts, 1976. 63 p. illus, index, bibliog. hard.
Describes the physical characteristics and habits of bats, and examines some of the myths and superistitions about them.

THE BEARS' NATURE GUIDE. Stan Berenstain and Jan Berenstain. New York, Random House, 1975. 64 p. illus. hard. $3.95.
On a nature walk, the bear family discover and learn about animals, plants and other wonders of nature.

BIOLOGY EXPERIMENTS FOR CHILDREN. Ethel Hanauer. New York, Dover, 1968. 96 p. illus, index. pap. $2.00.
Simple experiments which can be done either at school or at home to show basic scientific principles.

BLOOD AND GUTS: A WORKING GUIDE TO YOUR OWN INSIDES. Linda Allison. Boston, Little, Brown, 1976. 127 p. illus. pap. $4.95.
Discusses the elements of the human body; many diagrams and cartoonlike drawings help to explain human anatomy and physiology.

THE BOOK OF THINK (OR HOW TO SOLVE A PROBLEM TWICE YOUR SIZE). Marilyn Burns. Boston, Little, Brown, 1976. 128 p. illus. pap. $4.95.
What to do when you are puzzled or perplexed: a manual on problem solving and logic.

CARLOTTA AND THE SCIENTIST. Patricia Riley Lenthall. Chapel Hill, NC., Lollipop Power, 1973. 47 p. illus. pap. $2.00.
A scientifically-based story about a nonconformist penguin whose determination and curiosity lead her to adventure.

CHANGING IMAGES. Berkeley, CA., University of California Extension Division, n.d. 16mm film, sound, black & white. 25 minutes.

This six-week career education unit shows children exploring options, career possibilities and sex role stereotyping.

CHEMISTRY EXPERIMENTS FOR CHILDREN. Virginia L. Mullin. New York, Dover, c. 1961. 96 p. illus. pap. $1.75.

How to set up a home lab and do some simple chemistry experiments illustrating basic chemical and physical principles.

CIRCLES, TRIANGLES AND SQUARES. Tana Hoban. New York, Macmillan, 1974. n.p. illus. hard. $5.95.

Photographs of shapes as they are found in everyday objects, for the preschooler.

COMPUTING WITH THE TANGRAM: OPERATIONS WITH WHOLE NUMBERS, FRACTIONS, AND DECIMALS. Iris M. Carl. Englewood Cliffs, NJ., Prentice-Hall, 1977. 3 vols. illus. pap.

Collection of tangram puzzle activities that add another dimension in mathematical concepts.

CONTEMPORARY WOMEN SCIENTISTS OF AMERICA. Iris Noble. New York, Messner, 1979. 158 p. illus, index. hard.

Brief history of women in science precedes biographies of famous women of science, such as Estelle Ramey, physiologist, and Dixie Lee Ray, marine biologist.

CONTRIBUTIONS OF WOMEN: AVIATION. Ann Genett. Minneapolis, Dillon Press, 1975. 115 p, illus, bibliog. hard.

Biographies of six remarkable aviators; Amelia Earhart; Anne Lindbergh; Jacqueline Cochran; Jerrie Mock; Geraldyn Cobb; Emily Howell.

CONTRIBUTIONS OF WOMEN: SCIENCE. Diane Emberlin. Minneapolis, Dillon Press, 1977. 159 p. illus, bibliog. hard.

Brief biographies of six American scientists: Cannon, Gilbreth, Mead, Carson, Patrick, Clark.

CORN IS MAIZE: THE GIFT OF THE INDIANS. Aliki. New York, Thomas Y. Crowell, 1976. 34 p. illus. hard.

The story of corn, its varieties and many uses.

CREATIVE MATH BULLETIN BOARD GUIDE: GAMES AND INSTRUCTIONAL AIDS (FOR ELEMENTARY GRADES). Ann Courts. Minneapolis, T.S. Denison, 1970. 79 p. illus. pap.

Compilation of suggestions for bulletin boards, instructional aids and learning games for mathematics in elementary grades, which help children to reinforce concepts already learned and to enjoy the world of math.

CREATIVE MATH EXPERIENCES FOR THE YOUNG CHILD. Imogen Forte and Joy MacKenzie. Nashville, TN., Incentive Publications, 1973. 219 p. illus. pap. $5.95.

A math workbook for young children using mathematical concepts applied to the young child's environment, giving opportunities to use numbers in a natural and meaningful way.

ECO-ANTICS. Mable A. Hammersmith. Girl Scouts of the USA, 1974. 64 p. illus. pap. $1.25.

Information and descriptions of how-to projects on energy and ecology.

ECOLOGY FOR CITY KIDS. Erica Fielder and Carolyn Shaffer. San Francisco, The Ecology Center, n.d. 56 p. illus, bibliog. pap. $2.50.

This handbook of activities focusses on the involvement of children with the urban environment.

ECOLOGY IN YOUR COMMUNITY: EXAMINING YOUR ENVIRONMENT. Daniel F. Wentworth and others. Toronto, Holt Rinehart and Winston, 1975. 90 p. illus, index, bibliog. pap.

Well illustrated book, with many activities and projects for young children to learn about the environment and the interdependence of ecology.

ELEMENTARY SCIENCE PACKET NO. 7. National Science Teachers Association. Washington, D.C., N.S.T.A., 1976. packet. illus, bibliog. pap.

Collection of pamphlets on career exploration in science and technology for elementary grades, special section on women and minorities.

ENERGY ALL AROUND. Tillie S. Pine and Joseph Levine. New York, McGraw-Hill, 1975. n.p. illus. hard.

Sources and uses of various kinds of energy and the need for energy conservation are described.

EXPLORING FIELDS AND LOTS. Seymour Simon. Champaign, IL., Garrard, 1978. 64 p. illus, index. hard.

Simple projects introduce girls and boys to plants and animals found commonly in backyards and fields.

FREE TO BE... YOU AND ME. New York, McGraw-Hill, 1975. 6 filmstrips with cassettes; related games and activities.

Taken from the television show of the same name, this is probably the best set of materials for elementary children to explore their feelings and beliefs concerning sex roles and to begin to see new nonsexist, nonracist values and options.

FUN AND GAMES WITH MATHEMATICS. James Haugaard and David Horlock. Englewood Cliffs, NJ., Prentice-Hall, 1974. 302 p. illus, index. pap.

Resource book of games, patterns, puzzles and other activities to teach mathematical concepts in the elementary and junior high schools-worksheets can be produced from the book.

FUN WITH TANGRAMS KIT. Susan Johnston. New York, Dover, 1977. 32 p. + 2 sets of tangrams. illus. pap. $1.75.

Seven pieces of the tangram are used to duplicate silhouette figures illustrated.

THE GOOD TIME MATH EVENT BOOK. Marilyn Burns. Palo Alto, CA., Creative Publications, 1977. n.p. illus. pap.

Activities are presented which relate mathematics to everyday events.

GRASSROOTS SCIENCE: SET 1; BEGINNINGS. Chicago, Denoyer-Geppert Audio-Visuals, 1977. 4 filmstrips with cassettes + guide.

Information and close-up photographs enable children to see development of young creatures, such as tadpoles to frogs, and the hatching of a chick.

I CAN COUNT THE PETALS OF A FLOWER. John Wahl and Stacey Wahl. Reston, VA., National Council of Teachers of Mathematics, 1976. n.p. illus. pap.

Beautiful photos of flowers encourage children to count.

THE I HATE MATHEMATICS BOOK. Marilyn Burns. Boston, Little, Brown, 1975. 127 p. illus. pap. $3.95. (Brown Paper School series).

This book teaches people of all ages a new way to look at the world through mathematics, and suggests many strategies and projects to stimulate interest in math. Especially suitable for elementary grades.

I'M GOING TO BE... Berkeley, CA., University of California Extension Media Center, n.d. 16mm film, sound, color.
With a little bit of magic, a girl and a boy find out all about the different types of engineers; useful for career education, elementary, and staff development.

INSECT PETS: CATCHING AND CARING FOR THEM. Carla Stevens. New York, Greenwillow Books, 1978. 96 p. illus, index. hard.
A guide for girls and boys on catching and caring for insects, including building suitable homes for them.

JANE GOODALL. Eleanor Coerr. New York, Putnam's, 1976. 61 p. illus. hard.
Brief illustrated biography of a woman who went to Tanzania to observe chimpanzees in the wild.

KIDS CAN COUNT. Angela Wood. Toronto, Kids Can Press, 1976. n.p. illus. pap. $2.95.
Text in English, French, Chinese, Italian and Greek accompany pictures, to introduce children to counting.

KINDERGARTEN SCIENCE. Mildred Swift and Lois Rather. Minneapolis, T.S. Denison, 1964. 42 p. illus. pap.
Ideas and projects for young children to do, in order to learn some basic scientific concepts.

LET'S LOOK AT LOGIC. New York, Guidance Associates, 1977. 2 filmstrips with cassettes; 32 minutes.
Filmstrip set which presents children with basic concepts of logic, and includes the proposition that "girls can't understand logic." Introduces formal deductive logic and the use of a Venn diagram. Set includes logic cards for student use.

THE MAGIC OF SCIENCE FOR YOUNG CHILDREN. Esther Gordon-Nourok. San Rafael, CA., Academic Therapy Publications, 1975. loose-leaf. illus, bibliog. $7.50.
Simple experiments for young children to do themselves, illustrating basic scientific concepts.

MARIA MITCHELL: STAR GAZER. Katherine E. Wilkie. Champaign, IL., Garrard Publishing Co., 1966. (A Discovery Book). 80 p. hard. $3.40.
Life of the first Professor of Astronomy at Vassar and discoverer of a comet.

MARIE CURIE: DISCOVERER OF RADIUM. Joanne Landers Henry. New York, Macmillan, 1966. 44 p. illus. hard. $6.95.
Biography of extraordinary scientist who discovered radioactive elements, and was the only woman to win two Nobel prizes.

MARY'S MONSTER. Ruth Van Ness Blair. New York, Coward, McCann & Geoghan, 1975. 61 p. illus, bibliog. hard. $5.95.
Story of the discovery by young girl of fossils including Ichthyosaurus in Lyme Regis, England.

MEASUREMENTS AND HOW WE USE THEM. Tillie S. Pine and Joseph Levine. New York, McGraw-Hill, 1974. 48 p. illus. hard.
Stimulates children into practical, hands-on measuring exercises, using various measuring devices; illustrations show girls and boys, white and minority carrying out projects.

NEW WOMEN IN MEDICINE. Kathleen Bowman. Mankato, MN., Creative Education Press, 1976. 48 p. illus. hard.
Activities of women in different branches of medicine; neurologist, midwife, birth control advocate, endocrinologist.

PHYSICS EXPERIMENTS FOR CHILDREN. Muriel Mandell. New York, Dover, 1968. 96 p. illus, index. pap. $2.00.
Simple experiments which can be done with household materials to show basic scientific principles.

QUIET ON ACCOUNT OF DINOSAUR. Jane Thayer. New York, William Morrow, 1964. n.p. illus. hard.
A girl finds a dinosaur and becomes a famous scientist specializing in dinosaurs.

RACHEL CARSON: WHO LOVED THE SEA. Jean Lee Latham. Champaign, IL., Garrard, 1973. 80 p. illus. hard.
Biography of marine biologist who campaigned against pollution of the environment.

SAVE THE EARTH: AN ECOLOGY HANDBOOK FOR KIDS. Betty Miles. New York, Knopf, 1974. 95 p. illus, index, bibliog. pap. $2.50.
Information and projects on pollution of the land, water and air are described for young children.

SCIENCE EXPERIENCES FOR YOUNG CHILDREN. Rosemary Althouse and Cecil Main. New York, Teachers College Press, 1975. 10 vols. illus, bibliog. pap. boxed.
Activities designed to present simple scientific concepts to young children; areas include Water, Air, Wheels, Seeds, Magnets, Senses, Pets, As we grow, Colors, Food.

SCIENCE EXPERIMENTS YOU CAN EAT. Vicki Cobb. Philadelphia, J.B. Lippincott, 1972. 127 p. illus. pap. $3.95.
Based in the kitchen, scientific principles are demonstrated using food, which produce edible results.

SEE WHAT I CAUGHT! Ann Thomas Piecewicz. Englewood Cliffs, NJ., Prentice-Hall, 1974. 48 p. index. hard. $5.95.
Shows girls and boys catching and caring for small animals, from fields and ponds.

THE SIERRA CLUB SUMMER BOOK. Linda Allison. San Francisco, Sierra Club Books; New York, Scribner's, 1977. 160 p. illus. pap. $4.95.
Wide range of activities, of animal facts, includes craft projects and nature discussions, which can take place during the summer.

SIMPLE SCIENCE EXPERIMENTS: ELECTRICITY. Gordon A. Message. Cheadle, U.K., James Golt, 1965. 18 cards. illus. folder.
Simple instructions and illustrations on how to conduct experiments in electricity with young children and everyday objects.

666 JELLYBEANS! ALL THAT? AN INTRODUCTION TO ALGEBRA. Malcolm E. Weiss. New York, Crowell, 1976. 34 p. illus. hard.
This simple introduction to algebra for young children provides activities to find the unknown number.

SOLAR SAFARI AND SEVENTY OTHER SIMPLE SCIENCE GAMES FOR CHILDREN. M. Weber. Nashville, TN., Incentive Publications, 1978. 100 p. illus. pap. $5.00.
Based on concepts of science, these games may be used to introduce new topics, reinforce familiar ones, and prove that science need not be dull.

SOMETHING FOR SARA. Sandra Ziegler. Elgin, IL., Child's World, 1977. 32 p. illus. hard.
Sara, a Hispanic child, learns to make change and manage money.

STRAIGHT HAIR, CURLY HAIR. Augusta Goldin. New York, Crowell, 1966. 35 p. illus. pap. $1.45.
An easy-to-read book about different aspects of hair, straight, curly, wet and dry.

TANGRAMATH. Dale Seymour. Palo Alto, CA., Creative Publications, 1971. 126 p. illus. pap.
Workbook for students uses the tangram to reinforce mathematical concepts. (Could also be used in Junior High.)

THIS BOOK IS ABOUT TIME. Marilyn Burns. Boston, Little, Brown, 1978. 127 p. illus. pap. $4.95.
Describes different ways to look at, think about and explore time; includes activities.

VETERINARIAN, DOCTOR FOR YOUR PET. Arline Strong. New York, Atheneum, 1977. 44 p. illus. hard. $5.95.
The work of a veterinarian is described by showing the day-to-day activities of a woman vet.

WHAT CAN SHE BE? Gloria and Esther Goldreich. New York, Lothrop Lee and Shepard, 1972. 48 p. illus. hard. $5.00. (Series: A geologist; A veterinarian; An architect.)
The career and home life of a woman scientist is described by a typical day's activities.

THE WHOLE COSMOS CATALOG OF SCIENCE ACTIVITIES. Joe Abruscato and Jack Hassard. Santa Monica, CA., Goodyear Publishing, 1977. 134 p. illus, index. pap. $9.95.
Marvellous book of activities and ideas in many different areas of science, which encourages exploration and presents science in an enjoyable way; includes information on basic scientific theories and short biographies on scientists both male and female.

WOMEN IN SCIENCE. Barbara Stanford. Portland, ME., J. Weston Walch, 1975. 20 posters. illus.
Photographs of successful women of science, in all fields, are accompanied by a short text describing their achievements and activities.

ADA, COUNTESS OF LOVELACE: BRYON'S LEGITIMATE DAUGHTER. Doris Langley Moore. New York, Harper & Row, 1977. 397 p. illus, index, bibliog. hard. $25.00.
Biography of Byron's daughter who worked with Charles Babbage on mathematics and computers.

ALICE EVANS: BACTERIOLOGIST. The Center for Cassette Studies 7330, c1972. (Phono - tape - cassette).
A discussion is presented of Alice Evans' experimentation to prove her theory that cows and goats were infected with a disease which could be passed on to human beings. Includes bibliography.

ALICE HAMILTON: PIONEER DOCTOR IN INDUSTRIAL MEDICINE. Madeleine P. Grant. New York, Abelard-Schuman, 1967. 223 p. illus, index, bibliog. hard.
Biography of a woman who persisted against discrimination to become a doctor and pioneer in industrial medicine.

AMERICA'S FIRST WOMAN CHEMIST: ELLEN RICHARDS. Esther M. Douty. New York, Messner, 1961. 192 p. index, bibliog. hard. $3.50.
Life and achievements of the first woman student at Massachusetts Institute of Technology, and the founder of the American Home Economics Association.

AZTEC MATH: JUNIOR HIGH SCHOOL BOOK, 1. John H. Lettau and Bill McConnell. Santa Maria, CA., L & M Educational Enterprises, 1975. 40 p. illus. pap. $4.00.
Worksheets of patterns designed to teach junior high mathematics concepts and specific skills; should create more interest in assigned work.

THE CANCER LADY: MAUD SLYE AND HER HEREDITY STUDIES. J.J. McCoy. Nashville, Thomas Nelson, 1977. 191 p. illus, index. hard. $6.95.
Biography of a woman zoologist's untiring quest to establish a relationship between cancer and heredity.

CAREERS IN ENERGY. New York, Pathescope Educational Media; Associated Press, 1977. 2 filmstrips with cassettes + guide. 13 and 12 minutes.
Shows the great diversity of careers in the energy field, and discusses the requirements for a variety of jobs, from professional engineers to coal miners, and offshore rig operators.

CAREERS IN ENGINEERING AND ENGINEERING TECHNOLOGY. Mary McHugh. New York, Franklin Watts, 1978. 66 p. illus, index. hard.
Ten major engineering fields are described - jobs available, training required - with a resource list of engineering colleges and organizations; illustrations lack sufficient women.

CAREERS RELATED TO SCIENCE. New York, Denoyer-Geppert Audio-Visuals, 1977. 3 filmstrips with cassettes, + guide.
In personal interviews with men and women working in science, students are shown how they started, what they think about their work, and on-the-job illustrations.

CHEMISTRY CAREERS. L.B. Taylor, jr. New York, Franklin Watts, 1978. 62 p. illus, index, bibliog. hard.
Discusses careers in chemistry for women and men, in a variety of organizations: industry, business, and government.

COUNT ME IN: EDUCATING WOMEN FOR SCIENCE AND MATH. Oakland, CA., Mills College, 1978. Videotape + guide. 30 minutes.

This videotape documentary of a comprehensive curricular/career model program at Mills College is designed to help women enter scientific and technical fields; geared for college level, is useful for senior high school.

EARTH: OUR CROWDED SPACESHIP. Issac Asimov. New York, John Day, 1974. 160 p. illus, index, bibliog. pap.

Discusses the problems faced by the Earth's inhabitants as population increases and resources become limited.

FAMOUS MATHEMATICIANS. Pat Schouweiler and Diana Hestwood. Minneapolis, The Math Group, 1977. 40 p. illus. pap.

Using the lives and discoveries of famous women and men mathematicians, this workbook presents problems and puzzles based on mathematical skill - a novel approach.

THE FASCINATING WORLD OF WORK: CAREER AWARENESS SERIES. Richardson, TX., National Career Consultants, 1977. kit. (6 cassettes, filmstrips and guides + evaluation forms).

Explores different types of jobs, both professional and skilled trades, and enables the student to rate them according to life style, home life, security etc, as well as job content and satisfaction; set V includes electrical engineering, geology, welding, pharmacy and architecture.

FIRST WOMAN AMBULANCE SURGEON. Iris Noble. New York, Julian Messner, 1962. 192 p. index. hard. $3.34.

Biography of a woman who succeeded in joining the medical profession in New York City and was the first woman to serve as emergency ambulance surgeon.

THE FUN OF IT: RANDOM RECORDS OF MY OWN FLYING AND OF WOMEN IN AVIATION. Amelia Earhart. Chicago, Academy Press, 1977. 218 p. illus. pap. $4.95.

Famous woman pilot describes her career, and the days of early aviation, and the role women should have played in aviation.

GAMES FOR THE SCIENCE CLASSROOM: AN ANNOTATED BIBLIOGRAPHY. Paul B. Hounshell and Ira R. Trollinger. Washington, D.C., National Science Teachers Association, 1977. 246 p. index, bibliog. pap.

Annotated listing of games for science teachers, 1-12, to encourage participation in science through an interdisciplinary approach; includes instructions for play which are usually sexist in language.

HOW SCIENTISTS FIND OUT ABOUT MATTER, TIME, SPACE, ENERGY. Herman Schneider. New York, McGraw-Hill, 1976. 133 p. illus, index, bibliog. hard. $6.95.

Discusses scientific investigations with suggested experiments for further exploration.

HYPATIA'S SISTERS: BIOGRAPHIES OF WOMEN SCIENTISTS - PAST AND PRESENT. Seattle, WA., Feminists Northwest, 1976. 72 p. illus, bibliogs. pap. $2.00.

Anthology of short biographies, originating from a course "Women and science" at the University of Washington.

I'M MADLY IN LOVE WITH ELECTRICITY AND OTHER COMMENTS ABOUT THEIR WORK BY WOMEN IN SCIENCE AND ENGINEERING. Nancy Kreinberg. Berkeley, University of California, Lawrence Hall of Science, 1977. 36 p. illus, bibliog. pap. $1.00.

INTERN: A LONG YEAR. Chicago, Encyclopedia Britannica Educational Corporation, 1972. 16mm. film, color, sound. 20 minutes.
Shows a woman intern experiencing day-to-day occurrences in an inner city hospital, rotating through different departments; includes her home and social life. (Note: some scenes are not for the faint-hearted.)

KEEP EARTH CLEAN BLUE & GREEN: ENVIRONMENTAL ACTIVITIES FOR YOUNG PEOPLE. George and Dorothy Grant Hennings. New York, Citation Press, 1976. 250 p. illus, bibliog. hard. $9.95.
Source book of activities to help students to understand the causes of pollution and what can be done about them.

KEYS TO CAREERS IN SCIENCE AND TECHNOLOGY. Washington, D.C., National Science Teachers Association, 1973. 74 p. index, pap.
Lists resources for information on different careers in science and technology, including societies and associations.

THE KID'S POCKET CALCULATOR GAME BOOK. Edwin Schlossberg and John Brockman. New York, Morrow, 1977. 189 p. illus. pap. $3.95.
Using mathematical principles and concepts, games can be played by girls and boys using calculators.

THE LADY LAUREATES: WOMEN WHO HAVE WON THE NOBEL PRIZE. Olga S. Opfell. Metuchen, NJ., Scarecrow Press, 1978. 267 p. illus, index, bibliog. hard.
Short history of the Nobel prizes is followed by biographies of women who have won the Nobel prize in peace, literature, science.

LISE MEITNER: ATOMIC PIONEER. Deborah Crawford. New York, Crown, 1969. 192 p. index, bibliog. hard. $3.95.
Biography of an Austrian physicist who succeeded in splitting the atom in 1938.

MARIE CURIE. Robert Reid. New York, New American Library, 1974. 309 p. illus, index, bibliog. pap. $2.25.
Excellent biography of Marie Curie, Nobel prize winner, scientist, mother and wife.

MATH EQUALS: BIOGRAPHIES OF WOMEN MATHEMATICIANS PLUS RELATED ACTIVITIES. Menlo Park, CA., Addison-Wesley, 1978. 250 p. illus. pap.
Account of nine women mathematicians, their lives and their work, with mathematics activities which relate to their work, from Hypatia to Emmy Noether.

THE MATH/SCIENCE CONNECTION. San Francisco, Mills College, Math/Science Network, 1979. 16mm. film, sound, color. 25 minutes. $115.00
Excellent film depicts strategies in mathematics and science to encourage girls and women to learn and enjoy those subjects.

MATHEMATICS: A HUMAN ENDEAVOR. Harold R. Jacobs. San Francisco, Freeman, 1970. 529 p. illus, index. hard.
Subtitled "A book for those who think they don't like the subject", this book uses cartoons, diagrams, and games to explain basic functions.

MEN AND WOMEN BEHIND THE ATOM. Sarah R. Riedman. New York, Abelard-Schuman, 1958. 228 p. illus, index, bibliog. hard. $4.95.

Account of the lives and work of the people who worked on the discovery and control of atomic energy.

NON-TRADITIONAL CAREERS FOR WOMEN. Pathescope Educational Films, 1974. 2 filmstrips with cassette tapes.

Descriptions of and interviews with women in nontraditional careers, ranging from chef to architect, from "lineperson" to engineer.

ROSALIND FRANKLIN AND DNA. Anne Sayre. New York, Norton, 1975. 221 p. illus. hard. $8.95.

Biography of Rosalind Franklin, an English research chemist, describing her struggle to obtain recognition for her work in biochemistry, especially with DNA.

SCIENCE CAREER EXPLORATION FOR WOMEN. Walter S. Smith and Kala M. Stroup. Washington, D.C., National Science Teachers Association, 1978. 77 p. bibliog. pap. $2.50.

Activities with resource lists which can be easily integrated into the curriculum, in order to encourage girls to consider science careers.

SCIENCE PROJECTS FOR THE INTERMEDIATE GRADES. Maxine Springer Schneider. Belmont, CA., Fearon Publishers, 1971. 49 p. illus. pap. $2.50.

Activities for fifth and sixth graders, many for direct participation in different areas of science.

SCIENTIST VERSUS SOCIETY. Vivian Werner. New York, Hawthorn Books, 1975. 160 p. index, bibliog. hard.

Five men and one woman who found themselves at odds with the society of their times because of their scientific theories.

SEA AND EARTH: THE LIFE OF RACHEL CARSON. Philip Sterling. New York, Crowell, 1970. hard. $4.95.

The life of a naturalist whose books have alerted the public to the dangers of chemical insecticides.

SILENT SPRING. Rachel Carson. Boston, Houghton Mifflin, 1962. 368 p. illus, index, bibliog. hard.

This well-known book describes the destructive use of pesticides which upset the balance of nature affecting both animals and humans.

THE SKY'S THE LIMIT. Byron Films, n.d. 16mm. film, sound, color. 20 minutes.

Sponsored by the U.S. Department of Labor, this film shows three women including one black in apprenticeship programs; pipefitting in New Jersey, electrical in Detroit, and machining in California. They discuss their work, and social life.

SPACE FOR WOMEN: PERSPECTIVES ON CAREERS IN SCIENCE. Derived from Earth in the Cosmos: Space for Women, a symposium for women on careers in earth and planetary sciences. Cambridge, MA., 1975. 46 p. illus, index, bibliog. pap.

THE STARS BELONG TO EVERYONE. Helen Sawyer Hogg. New York, Doubleday, 1976. 274 p. illus, index, bibliog. hard. $12.50.

A wide-ranging book on astronomy and how everyone can enjoy it.

WATCHING THE WILD APES: THE PRIMATE STUDIES OF GOODALL, FOSSEY AND GALDIKAS. Bettyann Kevles. New York, Dutton, 1976. 164 p. illus, index, bibliog. hard. $8.95.
Describes the field work of three primatologists and their studies on the behavioral patterns of great apes.

WILD ANIMALS, GENTLE WOMEN. Margery Facklam. New York, Harcourt Brace Jovanovich, 1978. 139 p. illus, index, bibliog. hard. $5.95.
Describes the experiences of women who have become successful ethologists, and includes information on watching animals in their own habitat.

WOMAN IN SCIENCE - WITH AN INTRODUCTORY CHAPTER ON WOMEN'S LONG STRUGGLE FOR THINGS OF THE MIND. H. Mozans. Cambridge, MA., MIT Press, 1974. (1913). 452 p. illus, index, bibliog. pap. $4.95.
First published in 1913, this well-documented account of women's achievements in the realms of science starts in Ancient Greece and continues through the Victorian Era; includes an important chapter on women inventors.

WOMEN IN MATHEMATICS. Lynn M. Osen. Cambridge, MA., MIT Press, 1974. 185 p. illus, index, bibliog. pap. $4.95.
A new approach to the history of mathematics places women in the proper perspective and reassesses their contributions.

WOMEN IN SCIENCE: ILLUSTRATED INTERVIEWS. Dinah L. Moche. New York, Queensborough Community College of CUNY, 1975. multimedia folder.
Interviews with six scientists in different fields; includes cassette tapes, slides and short biographies to describe their work.

WOMEN'S WORK: ENGINEERING. Newton, MA., Education Development Center, 1977. 16mm. film, sound, color. 26 minutes.
Interviews with women civil, materials, and chemical engineers discuss education and training necessary to become engineers; this film shows women at work and at home, providing excellent role models.

ZOOMING IN: PHOTOGRAPHIC DISCOVERIES UNDER THE MICROSCOPE. Barbara Wolberg and Lewis R. Wolberg. New York, Harcourt Brace Jovanovich, 1974. 64 p. illus, bibliog. hard. $7.75.
Introduces the process and techniques of photographing a variety of items through a microscope.

CAREER PAMPHLETS

Many professional societies and business organizations produce career pamphlets; the ones listed below have made an effort to include women.

BE A COMPUTER LITERATE. Marion J. Ball and Sylvia Chorp. Creative Computing, Box 789M, Morristown, NJ 07960. $3.95.

CAREER BRIEFS IN VARIOUS CAREERS. Careers, Inc., Box 135, Longo, FL 33540. 35¢ each.

CAREERS IN AUTOMATIC DATA PROCESSING. National Business Education Association, Box 17402, Washington, D.C. 20061. $1.00.

CAREERS IN STATISTICS. American Statistical Association, 806 15th Street, NW, Washington, D.C. 20005. Free

CATALYST: CAREER OPTIONS SERIES FOR UNDERGRADUATE WOMEN. Catalyst, 14 E. 60th Street, New York, NY 10022. 1976. $1.75 each.

DENTISTRY: THE CAREER OF CHOICE FOR WOMEN. Council on Dental Education, American Dental Association, 211 E. Chicago Avenue, Chicago, IL 60611. Free.

KEYS TO CAREERS IN SCIENCE AND TECHNOLOGY. National Science Teachers Association, 1742 Connecticut Avenue, NW, Washington, D.C. 20009. $1.00.

MATH AND YOUR CAREER. U.S. Department of Labor, Bureau of Labor Statistics, Washington, D.C. 20005.

THE MATH IN HIGH SCHOOL...YOU'LL NEED FOR COLLEGE. Mathematical Association of America, 1225 Connecticut Avenue, NW, Washington, D.C. 20036. Free.

MEDICINE--A WOMAN'S CAREER. American Medical Women's Association, 1740 Broadway, New York, NY 10019.

PROFESSIONAL OPPORTUNITIES IN MATHEMATICS. Mathematical Association of America, 1225 Connecticut Avenue, NW, Washington, D.C. 20036. 50¢.

SCIENCE AND YOUR CAREER. U.S. Department of Labor, Bureau of Labor Statistics, Washington, D.C. 20005. 35¢

SO YOU'RE GOOD AT MATH... CONSIDER A CAREER AS AN ACTUARY. Society of Acturaries, 208 S. LaSalle Street, Chicago, IL 60604.

SPACE FOR WOMEN. American Astronomical Society, 211 Fitz Randolph Road, Princeton, NJ 08540. Free.

TWO HUNDRED WAYS TO PUT YOUR TALENT TO WORK IN A HEALTH FIELD. National Health Council, 1740 Broadway, New York, NY 10019. Free.

WOMEN ENGINEERS. Engineering Council for Professional Development, 345 E. 47th Street, New York, NY 10017. 25¢.

WOMEN IN PHYSICS. American Physical Society, Committee on the Status of Women in Physics, 335 E. 45th Street, New York, NY 10017. 50¢.

WOMEN IN SCIENCE AND TECHNOLOGY: CAREERS FOR TODAY AND TOMORROW. ACT Publications, Box 168, Iowa City, IA 52240. $1.50.

AWIM NEWSLETTER. Association for Women in Mathematics, c/o Department of Mathematics, Wellesley College, Wellesley, MA 02181. $10.00. quarterly.

This newsletter contains information on women in mathematics as well as resources and employment news.

AWIS NEWSLETTER. Association for Women in Science, 1346 Connecticut Avenue NW, Suite 1122, Washington, D.C. 20036. $10.00. bimonthly.

Association newsletter includes some short biographies, interviews with women working in science, as well as current events and employment information.

BEATING THE NUMBERS: A MATH CAREERS PROGRAM HANDBOOK. Boston, Boston Community Schools Board, n.d. 152 p. bibliog. pap. (Field edition.)

Handbook to assist counselors and math teachers to organize a program to help women improve their job options.

BUILDING EFFECTIVE MINORITY PROGRAMS IN ENGINEERING EDUCATION. National Research Council. Committee on Minorities in Engineering. Washington, D.C., National Academy of Sciences, 1975. 135 p. pap.

Surveys and evaluates minority engineering programs using data supplied by colleges and universities throughout the country.

CAREER GUIDANCE FOR WOMEN ENTERING ENGINEERING. Nancy D. Fitzroy, ed. Proceedings of an Engineering Foundation Conference, Henniker, N.H., 1973. New York, Society of Women Engineers, 1974. 192 p. pap.

Surveys general status of women in the engineering professions and provides role models speaking about their own experiences in different areas of engineering.

CONFERENCE ON THE PROBLEM OF MATH ANXIETY: PROCEEDING. Fresno, CA., California State University, School of Natural Sciences, 1978. v.p. bibliog. pap.

Papers report on a variety of programs to combat math anxiety with special attention paid to the problems of girls and women; includes activities.

DIRECTORY OF PEOPLE IN NONTRADITIONAL JOBS. Marylin A. Hulme and Susan Anczarki. Somerville, NJ., 1978. 24 p. illus, index, bibliog. (Free from NJ Department of Education, Trenton, NJ.)

This directory provides access to people in nontraditional jobs to serve as role models and speakers at Career Days in schools.

THE DOUBLE BIND: THE PRICE OF BEING A MINORITY WOMAN IN SCIENCE: REPORT OF A CONFERENCE OF MINORITY WOMEN SCIENTISTS. Shirley Mahalay Malcom and others. Warrenton, VA. Washington, D.C., American Association for the Advancement of Science, 1976. 70 p. bibliog. pap.

Surveys the status of minority women in science and provides recommendations for their education and employment.

EXPANDING YOUR HORIZONS IN SCIENCE AND MATHEMATICS. Joanne Koltnow. Oakland, CA., Mills College Math/Science Resource Center, (1979). 50 p. illus. pap.

This handbook helps to plan math/science conferences for high school women, to provide them with role models and information on many scientific and technical careers.

FACTORS ASSOCIATED WITH THE SELECTION OF ADVANCED ACADEMIC MATHEMATICS COURSES BY GIRLS IN HIGH SCHOOL. Elizabeth W. Haven. Princeton, Educational Testing Service, 1972. 66 p. bibliog.

Focusses on need to identify the characteristics of female students and teachers which encourage those talented in mathematics to pursue this subject and related fields regardless of sex role inhibitions.

GOALS FOR WOMEN IN SCIENCE. Women in Science and Engineering Inc. Boston, MA., 1972. 20 p. bibliog. pap.

Overview of science educaiton for women provides goals to increase participation of women in science.

HELP WANTED: SEXISM IN CAREER EDUCATION MATERIALS. Princeton, NJ., Women on Words & Images, 1976. Kodak carousel and cassette tape. 20 minutes.

Study of sex role stereotyping in a wide variety of career education materials.

HOW HIGH THE SKY? HOW FAR THE MOON? Sharon L. Menard. Washington, D.C., U.S. Department of Health, Education and Welfare, n.d. 116 p. illus, bibliog. pap.

Collection of resource materials on science and women, to be used in science curriculum, counseling, and role models provision.

IDENTIFYING YOUNG WOMEN WHO MAINTAIN EARLY DECISIONS TO ENTER CAREERS IN SCIENCE AND TECHNOLOGY. Hempstead, NY., Hofstra University, N.D. 136 p. bibliog. pap.

Research paper on young women changing their career aspirations from nontraditional areas to traditional ones, focussing on pressures and social expectations, which clash with early career choices.

THE MATHEMATICS FILTER AND THE EDUCATION OF WOMEN AND MINORITIES, Lucy Sells. Washington, D.C., ERIC Reports, 1976. 20 p. bibliog. pap.

Level of high school mathematics achievement acts as a critical filter to course choice at colleges and universities.

MIND OVER MATH. Stanley Kogelman and Joseph Warren. New York, Dial, 1978. 239 p. hard. $8.95.

To help overcome math anxiety, this book provides exercises and activities to allay myths and improve concentration.

OVERCOMING MATH ANXIETY. Sheila Tobias. New York, W.W. Norton, 1978. 278 p. illus, bibliog. hard. $10.95.

Based on a math anxiety clinic at Wellesley College, this book provides information on who the math avoiders are, and how to overcome fear of math.

PERSPECTIVES ON WOMEN AND MATHEMATICS. Judith E. Jacobs, ed. Columbus, OH., ERIC Clearinghouse for Science, Mathematics and Environmental Education, 1978. 165 p. bibliog. pap.

Collection of papers on the rate of participation of girls and women in mathematics; includes sections on math anxiety, sexism in mathematics textbooks and strategies for change.

A PLAN FOR IMPROVING MATHEMATICS INSTRUCTION IN CALIFORNIA ELEMENTARY SCHOOLS: FINAL REPORT. Joseph R. Hoffmann and Robert F. Tardif. Sacramento, CA., California State Department of Education, 1976. 55 p. pap. $1.25.

Through the identification of characteristics of successful mathematics programs, this report developed a plan to improve the teaching of mathematics; appendices include useful questionnaires and charts.

PROGRAMS IN SCIENCE FOR MINORITY STUDENTS, 1960-1975. Shirley Mahaley Malcom and others. Washington, D.C., American Association for the Advancement of Science, 1976. n.p. pap.

Describes a large variety of science programs nation-wide mostly at the undergraduate level, which encourages participation by minority students, including women.

SCIENCE, ENGINEERING, AND HUMANITIES DOCTORATES IN THE UNITED STATES: 1977 PROFILE. National Research Council. Commission on Human Resources. Washington, D.C., National Academy of Sciences, 1978. 85 p. pap.

Analyses of those who earned doctorate between 1934 and 1976 give information on subject areas, employment, and sex.

SCIENCE FRAMEWORK FOR CALIFORNIA PUBLIC SCHOOLS, KINDERGARTEN AND GRADES ONE THROUGH TWELVE. Sacramento, CA., State Department of Education, 1978. 103 p. illus, bibliog. pap.

Outline of science programs and materials includes such goals as student motivation, encouragement of girls into nontraditional areas, and the total learning experience.

SEXISM IN SCHOOL: WHAT WE CAN DO. Edith Chevat and Norma Harris. Freeport, NY., Educational Activities, 1976. Filmstrip with cassette. teacher's guide. boxed.

Designed as a tool for teachers, administrators and parents, this unit introduces sexism, and reviews studies and progress to date; strategies for change include materials evaluation, role reversal, role models and consciousness raising techniques.

THE STUDY OF THE ACADEMIC EMPLOYMENT AND GRADUATE ENROLLMENT PATTERNS AND TRENDS OF WOMEN IN SCIENCE AND ENGINEERING. Clare Rose and others. Los Angeles, Evaluation and Training Institute, 1978. 39 p. bibliog. pap.

Sociological analysis of the trends of women participating in science and engineering at the graduate level.

SUPPLY AND DEMAND FOR SCIENTISTS AND ENGINEERS: A REVIEW OF SELECTED STUDIES. Betty M. Vetter. Washington, D.C., Scientific Manpower Commission, 1977. 56 p. bibliog. pap.

Surveys numbers of degrees in life sciences, physical sciences and engineering, and comments on numbers of women.

UPWARD MOBILITY AND PROFESSIONAL DEVELOPMENT FOR WOMEN ENGINEERS. Proceedings of an Engineering Foundation Conference. New York, Society of Women Engineers, 1976. illus, bibliog. pap.

A WOMAN'S PLACE. Tarrytown, NY., Schloat Productions, 1974. 4 filmstrips with cassettes.

This set explores images, myths about women along with a discussion of biological vs. environmental theories of sex role development; it also describes the new women's movement.

WOMEN AND MATHEMATICS EDUCATION NEWSLETTER. c/o Judith Jacobs, George Mason University, Education Department, 4400 University Drive, Fairfax, VA. 22030. $3.00. Irregular.

This newsletter serves as a general communications link among all educators working in the field of women and girls in mathematics; includes resources and news of innovative programs.

WOMEN AND THE SCIENTIFIC PROFESSIONS: THE M.I.T. SYMPOSIUM ON AMERICAN WOEM IN SCIENCE AND ENGINEERING. Jacquelyn A. Mattfeld and Carol G. Van Aken, eds. Westport, CT., Greenwood Press, 1976. 250 p. index.

Papers from M.I.T. symposium discuss commitment required of a woman entering a scientific profession, and the case for and against employing women.

WOMEN IN GEOLOGY: PROCEEDINGS OF THE FIRST NORTHEASTERN WOMEN'S GEOSCIENTISTS CONFERENCE, ST. LAWRENCE UNIVERSITY, CANTON, NY. APRIL 26-27, 1976. Canton, NY., 1976. (Department of Geology and Geography, Monogr. 5).

Papers from the first women's geologic conference, including information on role models.

WOMEN IN HEALTH CAREERS: STATUS OF WOMEN IN HEALTH CAREERS IN THE UNITED STATES AND OTHER SELECTED COUNTRIES. Maryland Pennell and Shirlene Showell. Washington, D.C., American Public Health Association, 1975. 155 p. (ERIC Reports 113 553).

Chart book of comparative statistics on the employment status and opportunities of women in various health careers in developed countries.

WOMEN IN MATHEMATICS: PROBLEMS OF ORIENTATION AND REORIENTATION. Edith H. Luchins. Troy, NY., Rensselaer Polytechnic Institue, 1976. 62 p. pap.

Studies the problem of why there are few women in mathematics; explores what can be done to attract more women to this area. Questionnaires included.

WOMEN IN SCIENCE: A MAN'S WORLD. Impact of science on society, XXV:2, 1975. 172 p.

Collection of articles by women scientists from different countries re the difficulties a woman encounters in the field of science.

WOMEN IN SCIENCE AND MATHEMATICS: BIBLIOGRAPHY. Phyllis Zweig Chinn. Washington, D.C., American Association for the Advancement of Science, 1979. 38 p. pap.

Unannotated listing of books and articles about women in science and mathematics includes materials on sex differences in learning especially related to problem-solving and spatial relations, as well as education, employment and some biographies.

WOMEN IN SCIENCE AND TECHNOLOGY: U.S./USSR COMPARISONS. Gerhard F. Schilling and M. Kathleen Hunt. Santa Monica, CA., Rand Corporation, 1974. 68 p. bibliog. pap.

Demographic data used to compare the number of women in science and technology in the U.S. and the USSR, and their assessment as a national resource.

PROGRAMS

BAM. Blacks and mathematics; a secondary school lecture program. Contact: Dr. Tepper Gill, Department of Mathematics, Howard University, Washington D.C. 20059.

Directory of organizations in engineering programs for minorities. Contact: National Research Council, Committee on Minorities in Engineering, 2101 Constitution Avenue, NW, Washington, D.C. 20418.

Math/Science Network. Contact: Joanne Koltnow, Math/Science Resource Center, Mills College, Oakland, CA. 94613.

Mind over math. Contact: Dr. Stanley Kogelman, 370 Riverside Drive, New York, NY. 10025.

Visiting Women Scientists Program. Contact: Center for Educational Research and Evaluation, Research Triangle Park, NC. 27709.

Wellesley College, Department of Mathematics, Wellesley, MA. 02181.

Weslyan College Math Clinic. 547 Science Tower, Middletown, CT. 06457.

WAM. Women and mathematics, a secondary school lecture program. Contact: Dr. Susan Marchand, Department of Mathematics/Computer Science, Kean College, Union, NJ. 07083.

APPENDIX II-A

QUESTIONNAIRE: STUDENT ATTITUDES

by

Jozef Boniakowski

Eatontown School District

1. Are you male or female?
2. What is your favorite subject?
3. What is your worst subject?
4. In which subject do you receive the best grade?
5. In which subject do you receive the poorest grade?
6. State the reason why you received the best grade in the subject above.
7. State the reason why you received the worst grade in the subject above.

High school students may choose some of the subjects they wish to study. They may choose 0, 1, 2, 3, or 4 years of math, science, and other subjects.

8. How many years do you intend to study math in high school?
9. How many years do you intend to study science?
10. What position in science is a woman most likely to hold?
11. What position in math is a woman most likely to hold?
12. What position in science is a man likely to hold?
13. What position in math is a man likely to hold?
14. Can you name a scientist?
15. Can you name a mathematician?

QUESTIONNAIRE: STUDENT SEX BIAS

by

Elaine Parker

Piscataway School District

1. Who has the most influence concerning your future occupation? (a) teachers; (b) peers; (c) guidance counselors; (d) parents.

2. Do you think it is necessary for a female to have an occupation? (a) yes; (b) no.

3. Men and women make effectively equal auto mechanics? (a) yes; (b) no.

4. From whom have you found most of your information about various occupations? (a) parents; (b) teachers; (c) peers; (d) guidance counselors.

5. Is one sex able to express feelings more readily than the other sex? (a) yes; (b) no.

6. Can you list five occupations which only sex can perform? (a) yes; (b) no.

7. Are women restricted by the traditional female role? (a) yes; (b) no.

8. Are men restricted by the traditional male role? (a) yes; (b) no.

9. Are women able to play handball? (a) yes; (b) no.

10. Is there any difference in ability concerning academic studies in high school between boys and girls? (a) yes; (b) no.

11. Who selects your courses for school? (a) yourself; (b) parents; (c) guidance counselors; (d) classmates/peers.

12. Is there a difference in ability for math and science between men and women? (a) yes; (b) no.

13. Is there a difference in intellect between men and women? (a) yes; (b) no.

14. Can fathers handle housework as effectively as mothers? (a) yes; (b) no.

15. Do you have the same privileges and responsibilities as your brothers and sisters at the same age? (a) yes; (b) no.

16. What types of toys did you play with when you were young? (a) mechanical; (b) creative; (c) games.

17. When you were a child, were you pampered when you were hurt? (a) yes; (b) no.

18. Do you treat your brothers and sisters in the same manner? (a) yes; (b) no.

19. What is your parents' relationship to each other? (a) father is the head of the house; (b) mother is the head of the house; (c) parents share responsibilities.

20. Men and women are equally effective teachers. (a) yes; (b) no.

21. Is one sex able to make decisions more readily than the other sex? (a) yes; (b) no.

*22. How would you feel if your spouse made the same salary as you did? (a) indifferent; (b) would not care; (c) would care.

23. Do you feel that it is equally important for a woman to have an education as it is for a man? (a) yes; (b) no.

24. If you choose to marry, what type of relationship would you want to exist? (a) husband makes the important decisions; (b) wife makes the important decisions; (c) husband and wife make the important decisions.

25. Would you have confidence in a male nurse? (a) yes; (b) no.

26. If you had a child; (a) would you play equally hard with male as well as female children; (b) play harder with male children than female children; (c) play harder with female children than with male children.

27. If you had a male child; (a) would you restrict his toys to traditional toys; (b) would you let him play with any toy including traditional female toys; (c) would it make any difference to you what kind of toys he wishes to play with.

28. If you had a female child; (a) would you restrict her toys to traditional female toys; (b) would you let her play with any toy including traditional male toys; (c) would it make any difference to you what kind of toy she wishes to play with.

29. Would you have confidence in a female doctor? (a) yes; (b) no.

30. Which statement would your friends agree with? (a) boys are smarter than girls; (b) girls are smarter than boys; (c) boys and girls are equally intelligent.

31. Which of the following statements would your friends agree with the most? (a) boys are by nature more athletically oriented than girls; (b) girls are by nature more athletically oriented than boys; (c) there if no difference between boys' and girls' athletic ability.

32. Which statement would your friends agree with? (a) boys have a natural talent for science and math; (b) girls have a natural talent for math and science; (c) boys and girls have equal ability in math and science.

Please check the following appropriate boxes: Male ☐ Female ☐ Age ☐

*Question 22 was eliminated because the results proved too difficult to analyze.

Appendix II-C

QUESTIONNAIRE: STUDENT FEELINGS OF DISCRIMINATION

by
John Ziemba
Pascack Valley School District

This is a survey to determine if capable females feel discriminated against in the pursuit of careers in the fields of Mathematics or Science. Circle the word that best reflects your response to each of the questions. For the purpose of this survey Nursing should not be considered a field of Mathematics or Science.

*1) Would you feel uncomfortable in a Math/Science class if you were the only female?	NO	YES	UNDECIDED
2) Do you enjoy the study of Mathematics more than most of the other subjects you study?	NO	YES	UNDECIDED
3) Do you enjoy the study of one of the Sciences more than any of the other subjects you study?	NO	YES	UNDECIDED
4) Did you ever feel your parents were trying to discourage you from pursuing a career in the Math/Science fields?	NO	YES	UNDECIDED
5) Do you feel most people in our society feel a male is better suited for a career in Math or Science than a female?	NO	YES	UNDECIDED
6) Do you feel a woman should not be engaged in a career if she also has a family?	NO	YES	UNDECIDED
7) Do you feel most men feel there is a conflict in a female having both a family and an active career?	NO	YES	UNDECIDED
8) Do you feel most parents would rather fund a son in his pursuit of a career in Math/Science than an equally qualified daughter?	NO	YES	UNDECIDED
9) Do you feel being a female is a drawback in obtaining scholarships or loans for an education toward a career in Math or Science?	NO	YES	UNDECIDED
10) Has a Guidance Counselor ever discouraged you from pursuing a career in Math or Science because you are a female?	NO	YES	UNDECIDED

*11) In the fields of Math or Science, have you ever felt discriminated against by a teacher because you are female? NO YES UNDECIDED

12) Have you ever been ridiculed by your peers for showing an interest in the study of Math or Science? NO YES UNDECIDED

13) Have you ever felt inhibited in choosing to take a Math or Science course? NO YES UNDECIDED

If you answered yes, briefly explain why.

14) Do you plan on entering a Math or Science related field? NO YES UNDECIDED

If you answered no, briefly explain why.

15) Most medical doctors are male. Approximately 5% of all graduating engineers are female and only 1% of the engineers now employed are female. In your opinion, why is it that these fields are so dominated by males?

(*Questions 1 and 11 could be deleted to adapt questionnaire for use by male respondents.)

QUESTIONNAIRE AND RESULTS: PARENTS' INFLUENCE ON CAREER-CHOICE

by

Richard Rose
Monmouth Regional School District

Dear Parent:

It would be greatly appreciated if you could complete this survey question form and return it to me before April 30th.

The purpose of the survey is to determine if there are any factors that play a role in influencing high school students in selecting a post-high school career. If you feel the questions are too ambiguous or reflect an invasion of privacy, please do not answer those questions.

The survey is designed to allow for total anonymity, so, please do not include your name on the survey form. Your cooperation in this matter will be greatly respected.

Richard Rose, Advisor
CLASS OF 1976
Alumni Association
Monmouth Regional High School

APPENDIX II-D

SURVEY FORM

1. U.S. citizen ___ yes ___ no Date of birth___ ___ ___

2. Place of birth_______________________ town ___________ state

3. How many years has family of father been in the U.S. ___________
mother ___________

4. What is the country of origin of father's family ___________
mother's family ___________

5. Father's occupation______________ mother's occupation______________
H.S. graduate___________ H.S. graduate___________
college graduate___________ college graduate___________
years attended college_______ years attended college_______
highest degree obtained_______ highest degree obtained_______

6. Have you helped your son or daughter in their coming to a decision on a post-high school career? ___ yes ___ no

7. Do you feel that a career in science or math is a good choice? ___ yes ___ no

8. Do you believe that a female can succeed and advance in a science or math career in today's society? ___ yes ___ no

9. What factors were involved in your son's or daughter's choice of a non-science career?_______________________
factors in choosing a science/math career?_______________________

10. Do you believe that sex discrimination exists in the sciences/math fields at the college level? ___ yes ___ no
In post-college levels? (such as education, industry, business, or government) ___ yes ___ no
specify which ones_______________________

11. Are females able to compete with males in the math and sciences?

	Yes	No
math and sciences	___	___
humanities	___	___
social sciences	___	___
arts	___	___

12. Should female college graduates receive equal pay, recognition and promotions as do the males? ___ yes ___ no

APPENDIX II-D

RESULTS

SECTION ONE: PAIRED QUESTIONS: 1, 2, 3, 4

QUESTION 1: U.S. CITIZEN - YES - 46
NO - 2

QUESTION 2: PLACE OF BIRTH - U.S.A. EAST - 30
WEST - 7
NORTH - 1
SOUTH - 5
FOREIGN BORN - 5

QUESTION 3: HOW MANY YEARS HAS FAMILY OF FATHER AND MOTHER BEEN IN THE UNITED STATES?

	MOTHER'S FAMILY	FATHER'S FAMILY
0-10 years -	1	1
10	0	0
20	2	3
30	4	1
40	2	2
50	3	3
60	3	4
70	2	4
80	4	6
100plus	17	19
200-300	5	4

QUESTION 4: WHAT IS THE COUNTRY OF ORIGIN FOR THE FAMILIES OF THE MOTHER AND FATHER?

FATHER'S FAMILY	
TURKEY	1
AFRICA	1
GERMANY	12
RUSSIA	2
AUSTRO-HUNGARY	6
GREAT BRITAIN	6
BAHREIN	1
HOLLAND	1
IRELAND	2
ITALY	2
CHINA	1
POLAND	1
YUGOSLAVIA	1
SWEDEN	2
U.S.A.	6

MOTHER'S FAMILY	
DENMARK	1
LEBANON	1
AFRICA	1
GREAT BRITAIN	6
CHINA	1
RUSSIA	4
AUSTRO-HUNGARY	2
POLAND	4
GERMANY	9
IRELAND	6
SWITZERLAND	1
FRANCE	3
ITALY	2
HOLLAND	1
SWEDEN	1
ESTONIA	1
U.S.A.	5

APPENDIX II-D

SECTION TWO: PAIRED QUESTION: 5A, 5B, 5C, 5D

QUESTION 5A: FATHER'S AND MOTHER'S OCCUPATION?

FATHER'S OCCUPATION		MOTHER'S OCCUPATION	
MILITARY	5	HOMEMAKER	20
POLICE OFFICER	1	SWITCH OPERATOR	1
WRITER	1	SELF-EMPLOYED	1
ENGINEER	10	MEDICAL TECHNICIAN	1
SELF-EMPLOYED	3	SALES	1
EQUIPMENT SPECIALIST	2	NURSE'S AIDE	2
FARMER	1	LICENSED PRACTICAL NURSE	2
FINANCE	1	SUPERVISOR	1
AUTO MECHANIC	2	SECRETARY	3
ART DIRECTOR	1	REGISTERED NURSE	1
SCIENTIST	1	QUALITY INSPECTOR	1
EXECUTIVE	1	EDITOR	1
PHARMACIST	1	TEACHER	6
ELECTRONICS	3	LIBRARY CLERK	1
CARPENTER	1	TYPIST	2
COUNSELOR	1	BOOKKEEPER	2
TECHNICIAN	1	AIRLINE RESERVATION CLERK	1
SUPERVISOR	1	BANKER	1
ELECTRICIAN	1		
WELDER	1		
TEACHER	1		
PERSONNEL DIRECTOR	1		
COMPUTER SPECIALIST	2		
DENTIST	1		
PRINTER	1		

QUESTION 5B: LIMITS OF FORMAL EDUCATION FOR FATHER AND MOTHER?

FATHER'S EDUCATION		MOTHER'S EDUCATION
NON-HIGH SCHOOL GRADUATE	6	4
HIGH SCHOOL GRADUATE	13	28
COLLEGE GRADUATE	26	14

QUESTION 5C: NUMBER OF YEARS IN ATTENDANCE AT COLLEGE?

FOR FATHER		FOR MOTHER
ONE YEAR	0	4
TWO	5	7
THREE	2	2
FOUR	7	9
FOUR PLUS	21	5

QUESTION 5D: HIGHEST DEGREE OBTAINED?

FOR FATHER		FOR MOTHER
BACHELORS	10	11
MASTERS	17	1
DOCTORATE	3	0
ASSOCIATE	2	5

SECTION THREE: PAIRED QUESTIONS: 6, 7

QUESTION 6: HAVE YOU HELPED YOUR SON/DAUGHTER IN THEIR COMING TO A DECISION ON A POST-HIGH SCHOOL CAREER?

YES	33
NO	14
	1 (no response)

QUESTION 7: DO YOU FEEL THAT A CAREER IN SCIENCE OR MATH IS A GOOD CHOICE?

YES	44
NO	3
	1 (no response)

SECTION FOUR: PAIRED QUESTIONS: 9, 10

QUESTION 9: DO YOU BELIEVE THAT A FEMALE CAN SUCCEED AND ADVANCE IN A SCIENCE OR MATH CAREER, IN TODAY'S SOCIETY?

YES	42
NO	1
*MAYBE	5

* Expressed as "with difficulty."

QUESTION 10: WHAT FACTORS WERE INVOLVED IN YOUR SON'S OR DAUGHTER'S CHOICE OF A SCIENCE/MATH OR NON-SCIENCE/MATH CAREER?

SCIENCE/MATH (chosen by 29 responses)		NON-SCIENCE/MATH (chosen by 16 responses)	
PERSONAL INTEREST	16	NO PERSONAL INTEREST	11
HIGH SCHOOL PREPARATION	5	PARENT'S PROFESSION	4
PARENT'S PROFESSION	2	HIGH SCHOOL PREPARATION	4
PROFESSIONAL JOB OPPORTUNITY	9	FAMILY PRESSURE	2

SECTION FIVE: PAIRED QUESTIONS: 11, 12, 13

QUESTION 11A: DO YOU BELIEVE THAT SEX DISCRIMINATION EXISTS IN THE SCIENCE/MATH FIELDS AT THE COLLEGE LEVEL?

YES	22
NO	20

QUESTION 11B: DO YOU BELIEVE THAT SEX DISCRIMINATION EXISTS IN THE SCIENCE/MATH FIELDS AT THE POST-COLLEGE LEVEL? (SUCH AS EDUCATION, INDUSTRY, OR GOVERNMENT)?

YES	32
NO	13

QUESTION 11C: SPECIFY WHICH AREAS EXHIBIT SEX DISCRIMINATION

BUSINESS	7
TECHNOLOGY	1
ALL FIELDS	11
EDUCATION	3
INDUSTRY	9
MEDICINE	1
GOVERNMENT	1

QUESTION 12: ARE FEMALES ABLE TO COMPETE WITH MALES AFTER GRADUATION IN THE **

	YES	NO
MATH/SCIENCES	39	7
SOCIAL SCIENCES	42	4
HUMANITIES	43	3
ARTS	45	1

** COMMENTARY TO THE QUESTION

NOT IN ADMINISTRATION
FEMALES RECEIVE LOWER PAY, SLOWER PROMOTIONS
QUOTAS EXIST
FEMALES HAVE TO BE TWICE (2x) AS GOOD

QUESTION 13: SHOULD FEMALES RECEIVE EQUAL PAY, EQUAL RECOGNITION, AND EQUAL STANDARDS FOR PROMOTION, AFTER GRADUATION, AS DO THE MALES?

YES	NO
46	1

QUESTIONNAIRE AND RESULTS: MATH/SCIENCE IN PARENTS' CAREERS

by

Maxine Shepard Ingram, Franklin Township School District

Attached is a questionnaire to give a brief synopsis of the importance of Science/Math in one's job situations.

Please be honest in answering this questionnaire. All information will be compiled and hopefully edited for later use.

One's name is not required; merely one's sex, color, and career (job) and its duties. Please stress whether Math/Science is significant in successfully performing one's duties.

Has the Metric System (Math-Science) Affected Your Career Performance or Job Choice?

(Check the catagory which closely fits your situation)	Always	Sometimes	Never	Yes	No
(1) Do you see the need for math beyond 9th grade?					
(2) Is there a need for stressing the metric usage and its equivalence?					
(3) How often do you apply math-related abilities to your job situation?					
(4) If the opportunity presented itself, would you pursue a math or science-related career?					
(5) Have you failed a test (job-related) because of your lack of a solid background in math?					
(6) Have you actually used the metric system in any given situation?					
(7) Do you stress to your child/children the importance of math and science?					
(8) Would you like to see science required beyond one (1) year in High School?					
(9) If yes to #8, would your main preference be biology as one of the science selections?					
(10) Have you read any material which gives you an understanding of the Metric System?					

(11) Would you be interested in examining a metric (math-science) introductory unit?	Always	Sometimes	Never	Yes	No
(12) Is your job computer related?					
(13) Did you select your career because it required little/if any math or science, or both?					
(14) Have you conditioned your child to believe that math/science is strictly a man's subject area?					

Write a brief paragraph stating your career and duties ________________ also state whether you are a male or female. Include Math/Science as a function of your duties only where applicable.

APPENDIX II-E

RESULTS

NUMBER OF PARENTS RESPONDING TO QUESTION

QUESTION #	# NO	# YES	# NEVER	# SOMETIMES	# ALWAYS	# UNDECIDED
1	1	17		4	1	
2	6	11		4	1	
3		1	3	13	6	
4	13	9				
5	19	1	1	2		
6	13	6	1	2		
7	1	14		6	2	
8	6	16		1		
9	11	5		1		1
10	9	13	1			
11	8	15				
12	18	4				
13	20	2	1			
14	19	2	1	1		

APPENDIX II-F

ANALYSIS OF PICTURES IN ELEMENTARY SCIENCE TEXTBOOKS

by

Richard Chandler, Hamilton Township School District

The following three tables demonstrate relative percentages of males and females per grade level in each of three elementary school (K-6) science textbook series.

McGraw-Hill - Gateways to Science (1979)

	Male	Female
Level 1	54%	46%
Level 2	52%	48%
Level 3	55%	45%
Level 4	50%	50%
Level 5	55%	45%
Level 6	56%	44%
Series Average	54%	46%

Silver Burdett - Science: Understanding Your Environment (1978)

	Male	Female
Level 1	58%	42%
Level 2	59%	41%
Level 3	48%	52%
Level 4	62%	38%
Level 5	63%	37%
Level 6	53%	47%
Series Average	57%	43%

Houghton Mifflin - Modular Activities Program in Science (1975)

	Male	Female
Level 1	60%	40%
Level 2	55%	45%
Level 3	59%	41%
Level 4	59%	41%
Level 5	57%	43%
Level 6	51%	49%
Series Average	57%	43%

WOMEN IN SCIENCE TEST (PRETEST)
by
Wilton H. Kimmer, Jr.
Franklin Township School District

Give a brief statement about each of the following with regard to field of study.

Elizabeth Blackwell --

Dr. Frances O. Kelsey --

Emma Hart Willard --

Maria Mitchell --

Rose Hawthorne Lathrop --

Anna Botsford Comstock --

Dixy Lee Ray --

Margaret Mead --

Dr. Anna Howard Shaw --

Ellen Richards --

Annie Jump Cannon --

Florence Rena Sabin --

Mary Engle Pennington --

Lillian Moller Gilbreth --

Libbie Henrietta Hyman --

Wanda Farr --

Hazel K. Stiebeling --

Florence Seibert --

Rachel Carson --

Ruth Patrick --

Eugenie Clark --

IDENTIFICATION OF CAPABLE FEMALE DROPOUTS IN MATH

by

Bruce Yaches, South Plainfield High School

TO: All Guidance Counselors

FROM: Bruce Yaches

SUBJECT: Sexual Desegregation in Mathematics

I am currently participating in an institute at Douglass College which is focusing on sexual desegregation in mathematics. As part of the institute, I am doing a project on career awareness. To do so I have asked the math teachers to indicate those capable girls who do not intend to continue past the current year in math.

I am respectfully requesting your assistance in this matter. I have career information which I would like these young ladies to read. I would also like them to be aware of the fact that current studies have shown that girls who do not complete four years of high school math are cutting themselves off from a significant number of career possibilities. As an example, at the University of California, Berkeley, 75% of the majors require at least one year of calculus. Less than 25% of the entering female freshman have had enough high school math and thus can not pursue those majors.

Enclosed is a copy of the form I have distributed to the math department. When I get the names of those girls who might profit by this information, I would appreciate it if you would speak to them. I will make available to you the information which I have.

Your assistance in this matter will be greatly appreciated.

Bruce Yaches

APPENDIX II-H

Name of course ______________________________

Total enrollment in your section of course ______________________

Number of girls enrolled ______________

Number of girls maintaining at least a C average ______________

Number of girls with at least a C average who are not planning to take more math after this year ______________________________

Names of girls with at least a C average who are not continuing:

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________
6. ______________________________
7. ______________________________
8. ______________________________
9. ______________________________
10. ______________________________
11. ______________________________
12. ______________________________

EQUALITY IN EDUCATIONAL PROGRAMS: NEW JERSEY LAW

Department of Education
State Board of Education

EQUALITY IN EDUCATIONAL PROGRAMS

6:4-1.1 Purposes and Objectives

The New Jersey Constitution and implementing legislation guarantee each child in the public schools equal educational opportunity regardless of race, color, creed, religion, sex, ancestry, national origin, or social or economic status. To assure these basic rights the Commissioner of Education and the State Board of Education have developed these regulations which specifically implement N.J.S.A. 18A:36-20 and the State Board of Education Resolution concerning sex equality in educational programs. These regulations have also been developed in conformity with relevant Federal and State statutes concerning discriminatory conduct.

6:4-1.2 Definitions

(a) "Discriminatory practices" shall mean an action or failure to act based upon race, color, creed, religion, sex, ancestry, national origin, or social or economic status.

(b) "Educational activities and programs" shall mean all activities and programs conducted or sponsored by the school either during the school day or after regular school hours.

(c) "School" shall mean every public elementary or secondary school, every regional school, every county vocational school, or any other public institution providing special or general educational services to students from grades K through 12.

6:4-1.3 Policy Development

(a) Each local school district shall develop a policy of equal educational opportunity to be adopted as a resolution by the Board of Education. The school district shall inform the community it serves of this resolution by publicizing it in an adequate manner, including but not limited to the district's customary methods of information dissemination.

(b) Each local school district shall develop two affirmative action programs or plans, which shall include timetables for corrective action to overcome the effects of any previous patterns of discrimination which may exist and a systematic internal monitoring procedure to ensure continuing compliance.

1. One such program or plan shall include, but need not be limited to, action as required by Section 5, School and Classroom Practices, of this Subchapter.
2. Another program or plan shall include, but need not be limited to, action as required by Section 6, Employment/Contract Practices, of this Subchapter.
3. The programs or plans shall be made available for review to all interested parties.

(c) Each local school district shall designate a member of its professional staff as the affirmative action officer to coordinate and implement the district's efforts to comply. The progress of the district in complying shall be reported by the Superintendent to the Board of Education as it shall require.

(d) As part of its affirmative action programs or plans, each local school district shall arrange for or provide in-service training for school personnel on a continuing basis to identify and resolve problems arising from prejudice on the basis of race, color, creed, religion, sex, ancestry, national origin, or social or economic status.

(e) Each Board of Education shall adopt and approve courses of study, instructional materials, and programs designed to eliminate discrimination and promote understanding and mutual respect between children of different races, colors, creeds, religions, sexes, ancestries, national origins, or social or economic status. Community involvement in this process shall be encouraged.

(f) The local school district shall evaluate courses of study and instructional materials already in use to determine whether they are designed to achieve the objectives set forth in (e) and shall supplement them as necessary where they are not so designed. As the use of such courses and materials is discontinued in the normal course of events, the local school district shall replace them with courses and instructional materials designed to meet the objectives set forth in (e).

6:4-1.4 Technical Assistance

The Commissioner or designee shall provide technical assistance to local school districts for the development of policy guidelines, procedures, and in-service training for school personnel so as to aid in the elimination of prejudice on the basis of race, creed, color, religion, sex, ancestry, or social or economic status.

6:4-1.5 School and Classroom Practices

(a) No student shall be denied access to or benefit from any educational program or activity solely on the basis of race, color, creed, religion, sex, ancestry, national origin, or social or economic status.

(b) There shall be no differential requirements for completion of course offerings or courses of study solely on the basis of race, color, creed, religion, sex, ancestry, national origin, or social or economic status.

(c) There shall be no discrimination against students because of pregnancy, childbirth, pregnancy-related disabilities actual or potential parenthood, or family or marital status. A student shall not be excluded from any educational program or activity because of pregnancy or related conditions unless she so requests or a physician certifies that such exclusion is necessary for her physical, mental, or emotional well-being. If she is excluded for these reasons, she must be provided with adequate and timely opportunity for instruction to continue or make up her schoolwork without prejudice or penalty.

6:4-1.5 School and Classroom Practices (Continued):

(d) Public school students shall not be segregated on the basis of race, color, creed, religion, sex, ancestry, national origin, or social or economic status.

(e) No course offering, including but not limited to physical education, health, industrial arts, business, vocational or technical courses, home economics, music, adult education, shall be limited on the basis of race, color, creed, religion, sex, ancestry, national origin, or social or economic status.

(f) The athletic program, including but not limited to intramural, extramural, and inter-scholastic sports shall be available on an equal basis to all students regardless of race, color, creed, religion, sex, ancestry, national origin, or social or economic status. The athletic program as a whole shall be planned to insure that there are sufficient activities so that the program does not deny the participation of large numbers of students of either sex.

1. The activities comprising such athletic program shall receive equitable treatment, including but not limited to staff salaries, purchase and maintenance or equipment, quality and availability of facilities, scheduling of practice and game time, length of season and all other related areas or matters.

2. A school may choose to operate separate teams for the two sexes in one or more sports and/or single teams open competitively to members of both sexes, so long as the athletic program as a whole provides equal opportunities for students of both sexes to participate in sports at comparable levels of difficulty and competency.

(g) School personnel shall not use tests, procedures or other guidance and counseling materials which are differentiated or stereotyped on the basis of race, color, creed, religion, sex, ancestry, national origin, or social or economic status.

When informing students about possible career, professional and/or vocational opportunities, school personnel shall in no way restrict or limit the options presented to students on the basis of race, color, creed, religion, sex, ancestry, national origin, or social or economic status.

6:4-1.6 Employment/Contract Practices

(a) All persons regardless of race, color, creed, religion, sex, or national origin shall have equal access to all categories of employment in the public educational system of New Jersey.

(b) All New Jersey public school districts shall comply with all State and Federal laws related to equal employment, including but not limited to the New Jersey Law Against Discrimination (N.J.S.A. 10:5.1 *et seq*), Title VII of the Civil Rights Act of 1964, as amended by the Equal Employment Opportunity Act of 1972, Executive Order 11246 as amended, Equal Pay Act of 1963 as amended, and Title IX of the Education Amendments of 1972 (Higher Education Act).

(c) No school district shall enter into any contract with a person, agency, or organization if it has knowledge that such person, agency, or organization discriminates on the basis of race, color, creed, religion, sex, ancestry, national origin, or social or economic status, either in employment practices or in the provision of benefits or services to students or employees.

6:4-1.7 Compliance

(a) Each school district shall submit to the Commissioner of Education or designee a copy of its Resolution of Equal Educational Opportunity (See Section 3 (a) of this Chapter) and the name of its affirmative action officer (See Section 3 (c) of this Chapter) within 60 days of the effective date of these regulations.

(b) Each school district shall, within 120 days of the effective date of these regulations, submit its proposed program or plan of affirmative action for School and Classroom Practices (See Section 3 (b) of this Chapter).

(c) Each school district shall, within 180 days of the effective date of these regulations, submit its proposed program or plan of affirmative action for Employment/Contract Practices (See Section 3 (b) of this Chapter).

(d) The Commissioner or designee shall review the programs or plans, approve or reject said plans and shall notify the school system of his decision within 60 days of receipt of the plans.

(e) If the plan is in any way unacceptable, the Commissioner shall designate a person or persons to work with the school district to develop an acceptable plan, which must be completed and approved within 60 days of the receipt of the notice that the original plan was unacceptable.

(f) The plan must be initiated within a time period not to exceed 120 days from the time of its approval and must be fully implemented in accord with an approved time-table.

(g) If within one year of the effective date of the affirmative action plan a school district is still found not to be in compliance with these regulations or its plan was not implemented, the Commissioner may initiate, with the approval of the State Board of Education, action to suspend, terminate or refuse to award continued Federal or State financial assistance. The Commissioner may also make referral to any appropriate judicial and/or administrative Federal, State or local agencies.

6:4-1.8 State Review and Evaluation

(a) At least once every three years the Commissioner or designee shall review and evaluate the progress of each school district in implementing its affirmative action plan. If sufficient appropriations exist, the Commissioner may utilize the services of qualified independent consultants to effectuate the review and evaluation. The Commissioner shall provide each local school district with a copy of such analysis.

(b) The Board of Education of each local school district shall make available to the community a summary of the review and evaluation in accordance with the procedures adopted pursuant to N.J.A.C. 6:4-1.2 (a).

(c) Any and all inadequacies in the program plan as revealed in the review and evaluation shall be corrected as

6:4-1.8 State Review and Evaluation (Continued):

soon as is practicable, but in no case shall correction of the plan be delayed more than 60 days from receipt of notice of inadequacy or noncompliance. If such inadequacy is not corrected in the specified time, it shall result in the procedure described in 6:4-1.7 (g).

6:4-1.9 Appeals

In accordance with N.J.S.A. 18A: 6-9, any individual may petition the Commissioner of Education to resolve a dispute arising under these regulations pursuant to procedures set forth in N.J.A.C. 6:24-1.1 *et seq.*

6:4-1.10 Effect of Related Statutes

The obligation to comply with these regulations is not obviated or alleviated by any State or local law or rule or regulation of any organization, club, athletic or other league or association which would limit the eligibility or participation of any student on the basis of race, color, creed, religion, sex, ancestry, national origin, or social or economic status.

An order adopting these rules was filed and effective May 20, 1975, as R. 1975 d, 137.

This notice is published as a matter of public information.

For further information, contact Mrs. Nida E. Thomas, Director, Office of Equal Educational Opportunity, State Department of Education, 225 West State Street, Trenton, N.J. 08625. (Phone 609-292-5922)

MEMORANDUM ON ACTIVITIES TO RELIEVE MATH ANXIETY

by

Ruth Demkovich Mooney, Hamilton Township School District

TO: ______________________________

FROM: Ruth Demkovich

RE: Math Anxiety Workshop

DATE: April 24, 1978

I would first like to thank you for attending the workshop after school on Tuesday. I know you all are very busy and it made for quite a long day. I hope you found the session to be informative as well as helpful in your individual classrooms.

Relieving "math anxiety" among both boys and girls is the job of every classroom teacher. We must provide for both girls and boys activities which will enable them to develop a positive mental attitude regarding mathematics.

Sue Marchand presented several things you can do in your classroom. Please try at least one (or more) of the following this week in your class if you have not already done so. Send me a brief description of what you did and the responses, reactions or feelings of your students by Friday, April 29. If possible please list boys and girls separately and include the number of each response.

If you do not have time this week and have not done any of these activities previously, please plan to try one before the end of the year. Send me a description of what you plan to do, method of presentation and expected outcome.

Some of the activities Sue presented are:

(1) Discuss with students their feeling about mathematics, how much math they plan to take, future job plans (if they know) and parents' attitude toward math.

(2) Have students look at their textbooks and determine if they are sex-biased.

(3) Have students make up word problems, compare those made by the boys and the girls, discuss results (whether or not they are sex-biased).

(4) Use Tangrams to form various shapes.

(5) Any other activities you feel are appropriate.

I would appreciate it if you would send me the results or your plans by Friday, April 29, as my report for Rutgers must be presented on Tuesday, May 2. Thank you very much for your time and help with this project.

THE JET CANARD

Provided by Herbert S. Herman

Bronx (N.Y.) Community School District 10

Materials: Balsa wood or styrofoam plastic (can use discarded meat trays); small block of wood; brads; rubber bands; glue; clothespin; thin wire.

Parts may be traced and cut from balsa wood, styrofoam plastic, or even stiff paper.

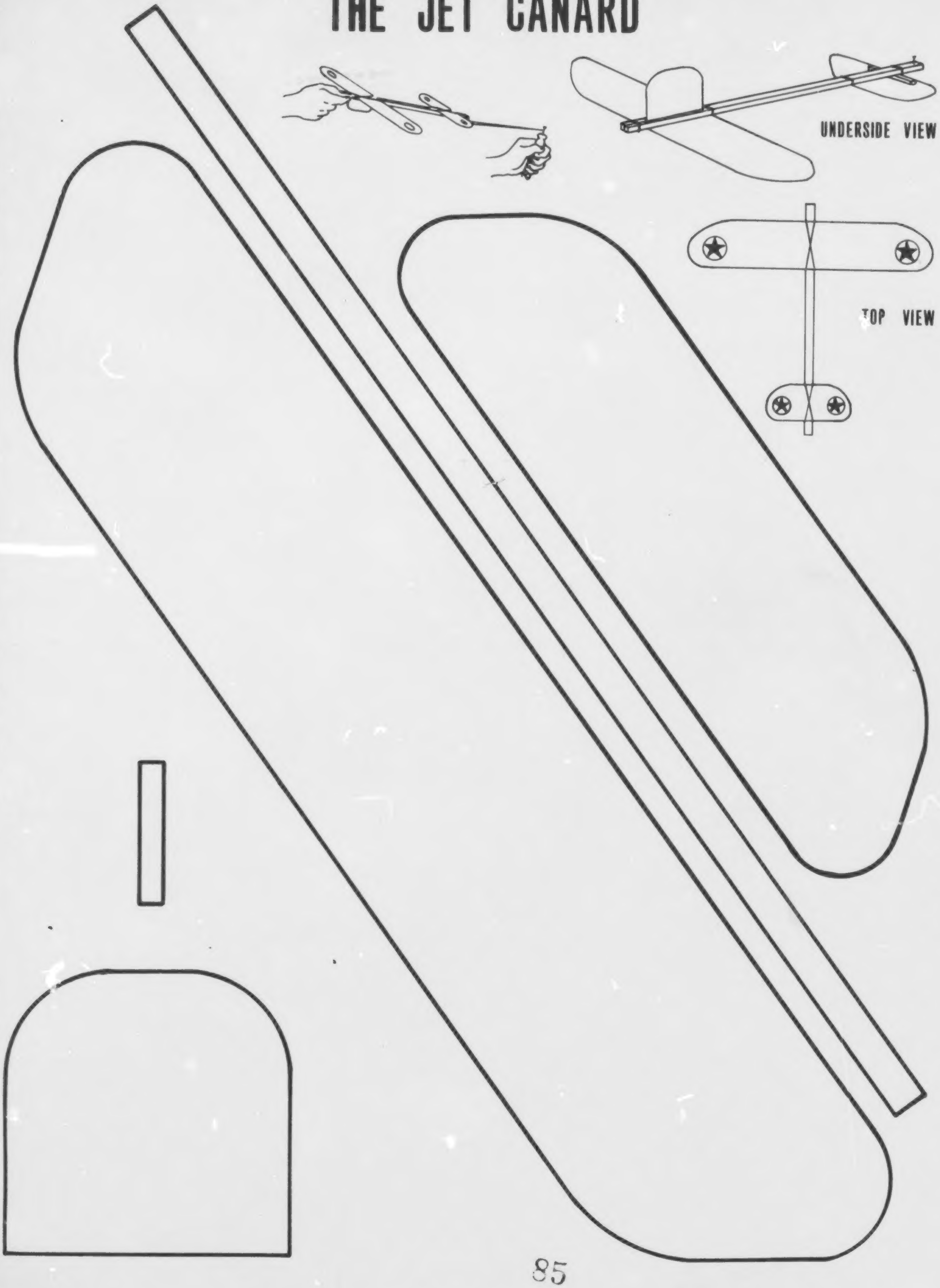
Directions: Glue the small block of wood to the middle of the front edge of the underside of the small wing. Drive a brad into the lower side of the stick of wood near the front. Lay the large wing across the strip of wood just above the rudder and fasten it in place with a rubber band. Fasten the small wing near the front end of the strip of wood with a rubber band. The small block of wood will rest on the strip of wood and will hold the small wing at a slant.

Drive a brad in the head of the clothespin, leaving about 1/4 in. of it projecting above the head. With the wire fasten a rubber band to the brad. The clothespin and rubber band will serve as a slingshot.

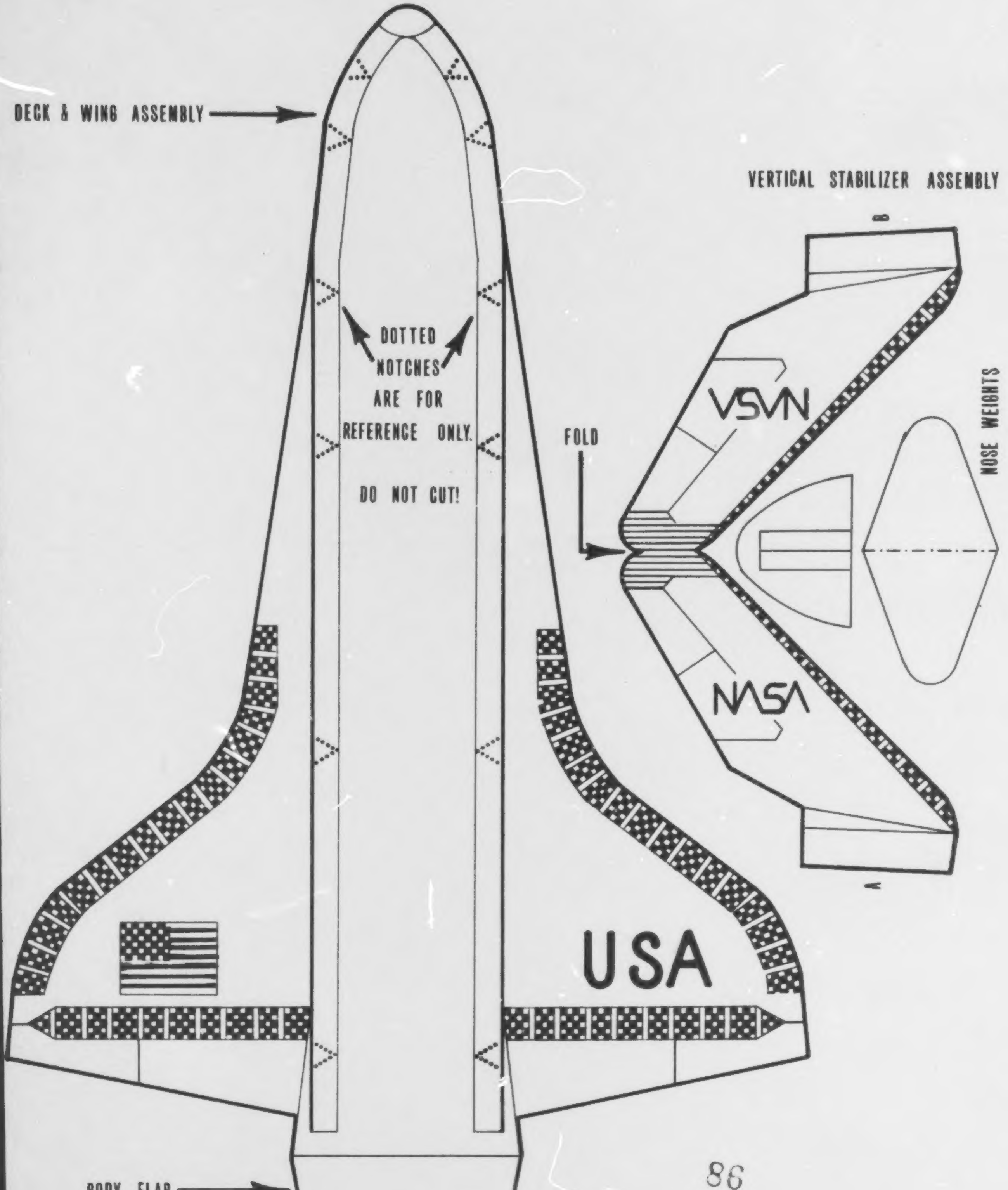
The glider is shot small wing first. To shoot it, catch the brad of the glider in the rubber band of the slingshot. Pull the glider back until the rubber band is stretched tight and then let it go.

This glider should go for a considerable distance and should be shot only out of doors. You should be able to make it loop the loop. Indoors, throw it instead of using the slingshot.

THE JET CANARD



PHOTOCOPY ON PAPER AS HEAVY AS POSSIBLE



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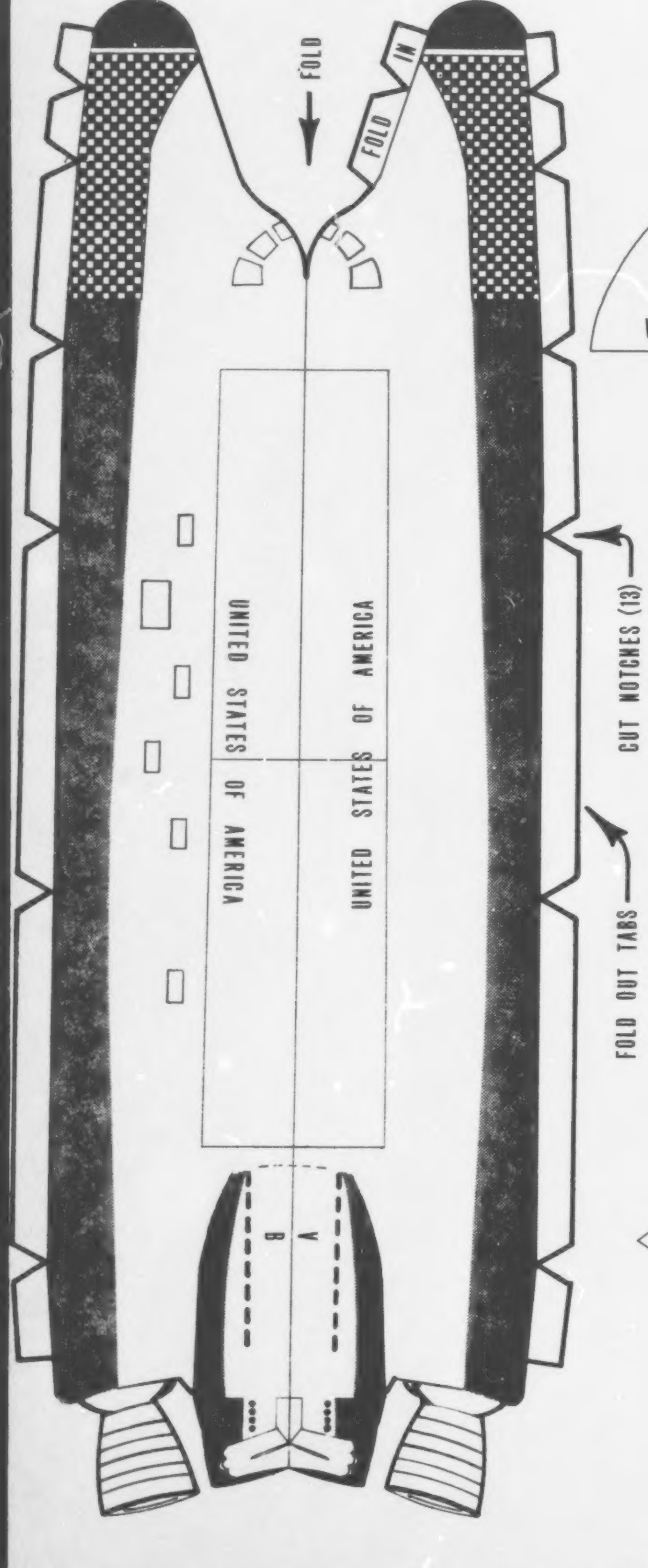
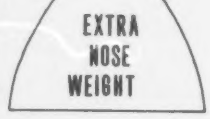
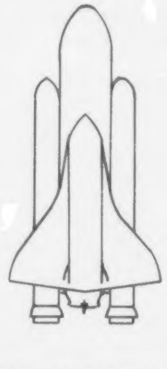
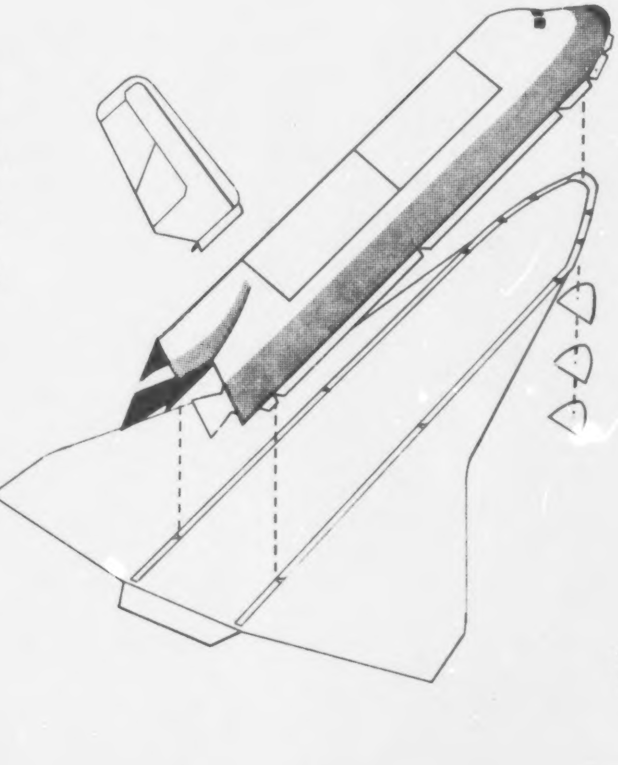






LAUNCH CONFIGURATION



6 1

APPENDIX IV-A

Our ×

5 Math · —

Workbook 2

× 8 ÷

7 4 = 9 3

Dr. Horn's
2-3 Combination Class

APPENDIX IV-A

Our class took a pre-test on word problems. Many of us made lots of errors. We talked about them. Dr. Horn said that at a workshop she learned that math problem in books often have children doing things that are not true-to-life.

When we read the problems again, we found that the girls in the book were always cooking, sewing and playing with dolls. Boys were playing ball, building things, and running races.

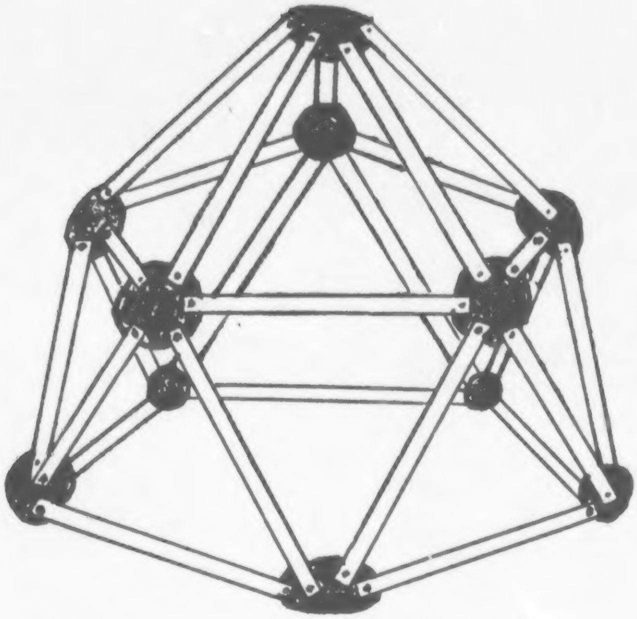
We decided to write our own word problems about true things that really happened to us. This workbook is full of our own problems. We think it is more fun to do these problems than those in the book. We hope you have fun too.

Math 2-3 H

Math-Science Curriculum Development Project
Training Institute for Sex Desegregation
Douglass College, Rutgers University

APPENDIX IV-B

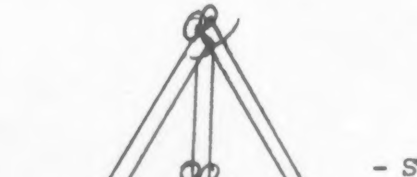
GEODESIC DOME



● - OAKTAG PLATES

▭ - TUBES OF ROLLED NEWSPAPER OR OAKTAG STRIPS

TETRAHEDRON



- STRAWS AND STRINGS

Nicole Goldstein

APPENDIX IV-A

I bought a note book that costed 26. I also bought 6 pencils for 26¢. I also bought two pieces of bubble gum that costed 5¢ each. I had a dollar with me how much did they add up to, and how much change did I get back?

They cost- 62¢ change- $.38

Eduardo Sosa V.

APPENDIX IV-A

gimmy and John and I
won 30 pieces of candy.
We divided it How
many pieces did
each of us get?

10 pieces

Dawn Farr

APPENDIX IV-A

There were 15 girls playing Kickball, 17 Boys came and wanted to play. How many all together?

Rachel Adler

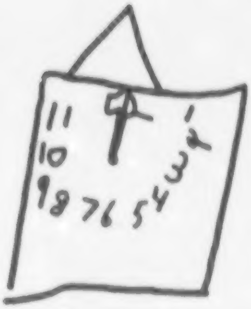
APPENDIX IV-A

One there was a
hotdog lunch. The hotdogs
were 35¢. The cupcakes
were 10¢. The drinks
were 10¢. The potatochipes
were 10¢. I brought
85¢. How much did I have left?
I bought One of each?

$ 0c

Michael Gildenberg.

Once I wanted to figure out somthing with hours and days. I Knew that 7 da were in a week and 24 hours in one day. So how much hours in a week?



168 hours in a week

APPENDIX IV-A

Josh Kolnick

Yesterday I saw a Rutgers game. The score was 24 to 17. I wanted to know how much Rutgers was up by.

7 points

Cynthia Sherbin

On my birthday my grandmother gave me a dress that was too big. I took it back to the store to get another one. They didn't have my size, so I had to choose another style dress. The new dress cost $18. 99. The dress my grandmother got me cost $15.95. How much money will I have to give the sales girl for the new dress?

Robbie Schwartz

On winter vacashon I whent to califoria, to get on the plane it cost $250. I have five people in my family but my baby sister didn't go. How much money did my father need to spent to get everybody who was coming in my family to california?

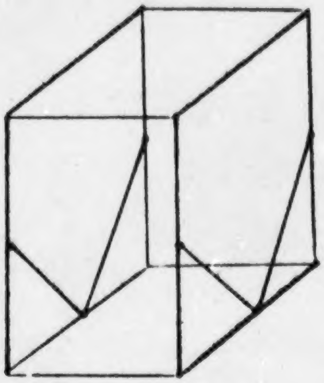
0001

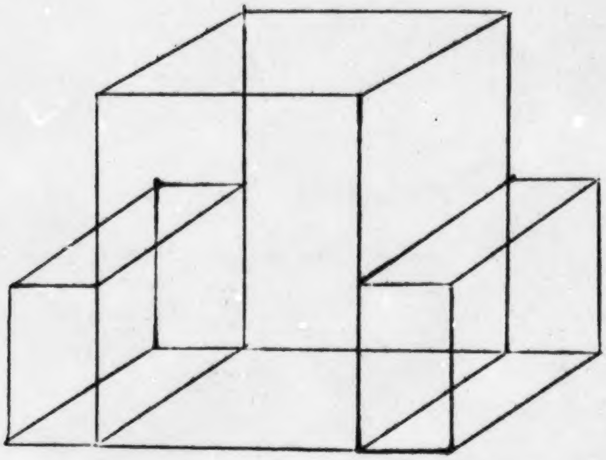
APPENDIX IV-A

Dawn Farr

yesterday I was flipping base Ball cards with Clifford. I had 51 cards and I won 20 more. How many did I have then?

STRUCTURES WITH STRUTS AND BUTTRESSES





APPENDIX V-A

QUESTIONNAIRE AND RESULTS: ATTITUDES TOWARD OCCUPATIONS AND SEX ROLES

by

Paul Desmond, Eatontown School District

This is a questionnaire on your attitudes toward roles in life. You are to put a check on the blank that you feel best indicates the sex of the person who would most likely hold the job.

	FEMALE	MALE
A letter carrier		
A business owner		
A secretary		
An airline attendant		
A nurse		
A religious person		
An assistant		
A florist		
An agent		
An athlete		
An artist		
A cook		
A sales person		
A teacher		
A fire fighter		
A high school teacher		
A professor		
A person you can trust		
TOTAL NUMBER EACH		

Name ________________________________

I enjoyed this questionnaire because ________________________________
____.

I did not like this questionnaire because ________________________________
____.

APPENDIX V-A

RESULTS OF QUESTIONNAIRES BEFORE AND AFTER CLASSES ABOUT SEX DISCRIMINATION

POSITION	THIRD GRADE				SIXTH GRADE			
	BEFORE		AFTER		BEFORE		AFTER	
	Female Job	Male Job	Female Job	Male Job	Female Job	Male Job	Female Job	Male Job
Letter carrier	2%	98%	18%	82%	5%	95%	20%	80%
Business owner	4%	96%	36%	64%	20%	80%	12%	88%
Secretary	96%	4%	90%	10%	100%	0%	99%	1%
Airline attendant	96%	4%	97%	3%	95%	5%	94%	6%
Nurse	99%	1%	98%	2%	90%	10%	90%	10%
Religious person	48%	52%	45%	55%	60%	40%	52%	48%
Assistant	36%	64%	40%	60%	40%	60%	43%	57%
Florist	40%	60%	51%	49%	75%	25%	72%	28%
Agent	20%	80%	37%	63%	55%	45%	60%	40%
Athlete	40%	60%	47%	53%	15%	85%	30%	70%
Artist	62%	38%	51%	49%	40%	60%	50%	50%
Cook	55%	45%	54%	46%	50%	50%	57%	43%
Sales person	45%	55%	40%	60%	30%	70%	36%	64%
Teacher	46%	54%	57%	43%	40%	60%	48%	52%
Fire fighter	35%	65%	30%	70%	35%	65%	37%	63%
High school teacher	40%	60%	46%	54%	35%	65%	37%	63%
Professor	20%	80%	22%	78%	5%	95%	7%	93%
Person you can trust	35%	65%	51%	49%	20%	80%	29%	71%

APPENDIX V-B

WOMEN IN NONTRADITIONAL CAREERS INVITED TO 5th GRADE CLASS

by George O. Howard
S. Orange/Maplewood School District

Barbara B. Kebbekus--Newark College of Engineering--Chemist

Jane Burgio--State Legislator

Susan Marchand--Kean College--Mathematics Department--Mathematician

Susan Tobias--Summit Animal Hospital--Veterinarian

Helen Young--Bank Vice President

Judith S. Weis--Rutgers University, Newark--Marine biology--Embryology

Marsha Rabinowitz--Princeton University--Department of Engineering--Student

Ardath P. Day--Rutgers University, Newark--Engineer and Computer Analyst

Carolyn Clark--Equitable Life--District Manager

Arlene D'Lauro--Bell Telephone--Supervisor

Theresa Holt--Essex Community College--Psychologist

APPENDIX V-C

QUIZ ON SEXIST LANGUAGE

by
Linda Petruzzello, Passaic County Technical and
Vocational High School

Name________________________________ Date______________

Checkmark the statements you believe are sexist. Where possible, change a word (or words) to make the statement nonsexist.	Number of students who checked the item (total number of students: 20)
1. The postman delivered the letters early	________
2. The nurse said she had a difficult time giving the injection.	________
3. A policeman was ticketing the car as I passed.	________
4. Only students who like math should become draftsmen.	________
5. The stewardess smiled sweetly as she offered us a drink.	________
6. My mother is only a housewife.	________
7. God created man on the sixth day.	________
8. The department store is advertising for a stockboy.	________
9. One small step for man, one giant step for mankind.	________
10. The fireman contained the blaze quickly.	________

APPENDIX VI-A

LIBRARY ASSIGNMENT ON WOMEN IN MATHEMATICS

by

Walter H. Tylicki, Linden High School

I. RATIONALE

The purpose of this assignment is to show that there is a place of women in mathematics and science. It is hoped that through this and other activities women will be encouraged to prepare for careers in these fields.

Ninety percent of all women are in the labor force for some portion of their lives. The average woman is employed for 30 years (1974) compared to 43 years for men. This statistic indicates that women should prepare for a vocation which will continually challenge all their abilities and knowledge.

II. REQUIREMENTS

Write a report at least one page in length on women's contributions to mathematics, including a bibliography listing the book(s) and/or article(s) used. The report could be on a woman's contribution to mathematics during a particular period, a contrast of the lives of various women in mathematics, the status of women in mathematics, contemporary women in mathematics, or any variation on this theme acceptable to your teacher.

III. SOME FAMOUS WOMEN IN THE HISTORY OF MATHEMATICS

Hypatia (370-415) First woman mathematician.

Hroswitha (about 900) a nun who wrote about science and mathematics.

Maria Agnesi (1718-1799) mathematician.

Carolyn Herschel (1750-1847) mathematician.

Sophie Germaine (1776-1831) mathematician, wrote under the pen name of M. LeBlanc.

Mary Fairfax Somerville (1780-1872) physicist, astronomer.

Ada Lovelace (1815-1852) developed calculating machines.

Sonya Kovalevsky (1850-1891) mathematician.

Emmy Noether (1882-1935) mathematician.

Emilie du Châtelet (1706-1749) mathematician, physicist.

Library Assignment on Women in Mathematics (cont.)

Maria Mitchell (1818-1899) astronomer.

Ellen Swallow (1842-1911) chemist, environmentalist.

Marie Sklodowska Curie (1867-1931) physicist.

Chien Shiung Wu (1915-   ) physicist.

Sophia Brahe (16th century) astronomer.

Maria Kirsh (18th century) astronomer.

Maria Cunitz (17th century) astronomer.

Margaret Maltby (1860-1944) physicist.

Lise Meitner (1878-1968) physicist.

Gerty Cori (1896-1957) biochemist.

Irene Joliet-Curie (1897-1956) chemist.

Maria Goeppert-Mayer (1906-1972) physicist.

Charlotte Scott (1858-1931) one of the founders of the American Mathematics Society.

Julia Robinson--mathematician recently elected to the National Academy of Science.

Christine Ladd Franklin (1847-1930) first American woman to earn a doctorate in mathematics.

IV. SOME HINTS TO AID YOU IN YOUR INVESTIGATION

Check the following sources:

A. The card catalog for entries on the women listed above.

B. The research guide index for various encyclopedias.

C. The Reader's Guide to Periodical Literature under the heading of "Women" and its various subheadings.

D. Facts on File under the heading "Women--employment."

E. The Good Housekeeping Woman's Almanac.

F. The World Who's Who in Science.

G. Seek the assistance of the librarian.

WOMEN IN SCIENCE: POSTER ASSIGNMENT

by

Joyce Kirchin, Clinton Township School District

Have you ever noticed how often, in a science textbook, the authors talk as if all scientists are men? You might read, for example, that "...when a scientist makes a discovery, he..." Not very often, "...she..." or even "...he or she..."

It is true that the great majority of scientists in Western civilization have been men. On the other hand, there have been women who have made very significant contributions to the development of our knowledge in chemistry, physics, and biology. More to the point, science has had few women scientists because of the peculiar attitude which society has had about the "place" of women in our culture. Men have been perfectly willing to let women bear the children, keep the home, and do simple agricultural chores. The real professions have generally been denied to women.

Today there are probably more women engaged in scientific research in the United States. We have finally realized what an enormous waste of talent our short-sighted view of women has cost us. Even more important, we have finally recognized the injustice to women who want to pursue a career and who are able to do so. The purpose of this activity is to help you find out something about the role of women in science, past and present. You are to choose one woman to report on.

To begin with, there are certain very famous women in the history of science about whom you can read very easily. Such names would include those of Madame Curie, her daughter, Irene Joliot-Curie, and Lise Meitner. On the other hand, you might prefer to learn about modern women in the sciences. Possible sources of information here would be scientific offices and institutions in your own community (the local hospital, environmental protection agency, university or college, or the like), local or national industries (General Electric, Westinghouse, Bell Telephone, and the like), or state or federal governmental agencies (United States Department of Agriculture, National Space and Aeronautics Administration, National Science Foundation, and the like). The last of these is likely to be the most fruitful source for this research.

You should begin by finding out as much about the woman you have chosen as possible. How did she get interested in science? What educational and employment problems did she run into? What recommendations or suggestions would she have for other women interested in a scientific career. When you have located this information, prepare a "report" in the form of a recruiting poster designed to interest more women in scientific careers. Make the poster visually attractive and appealing, but also provide women with the information and ideas they will need to get them interested in a career in research.

APPENDIX VI-C

Notable Women of Science

KALAMAZOO PUBLIC SCHOOLS • KALAMAZOO, MICHIGAN
Division of Instructional Management
March 1974

Foreword

This bibliography identifies women known for their contributions to the field of science. It is intended to assist students and teachers of secondary science as they use materials commonly found in high school media centers.

The bibliography has been developed in three parts:

Part 1: List of women arranged by the field of science in which each has made a contribution.

Part 2: List of references used.

Part 3: List of books on careers and opportunities in science.

NOTABLE WOMEN OF SCIENCE

(A beginning list)

Broad areas of science were used for headings in an attempt to place women in general areas of accomplishment. Some of the women's careers overlap into areas of science other than where their names are found on this list. Names that are starred(*) indicate that biographical information can only be found in the books listed under the COLLECTIVE BIOGRAPHIES section.

ANTHROPOLOGISTS

Benedict, Ruth 1887-1948

Hours-Miedan, Magdeleine 1915-

Marriot, Alice 1910-

Mead, Margaret 1901-

ASTRONAUTICS AND AVIATION

Auriol, Jacqueline 1917-

Cobb, Jerrie 1931-

Cochran, Jacqueline 1910(?)-

Dougherty, Dora 1921-

Earhart, Amelia 1898-1937

Gower, Pauline 1910-1947

Grizodubova, Valentina 1910(?)-

Miles, Mary 1900(?)-

Tereshkova, Valentina 1937-

ASTRONOMERS

Cannon, Annie Jump 1863-1941

Fleming, Williamina Paton Stevens 1857-1911

*Hogg, Helen Sawyer 1905-

Leavitt, Henrietta Swan 1868-1921

Makemson, Maud 1891-

Mitchell, Maria 1818-1889

ASTRONOMERS (cont'd)

Whiting, Sarah Frances 1847-1927

Whitney, Mary Watson 1847-1920

Wright, Helen 1914-

BIOLOGIST

Adamson, Joy 1910-

Carson, Rachel 1907-1964

Crane, Jocelyn 1909-

Eigenmann, Rosa Smith 1858-1947

Emerson, Gladys Anderson 1903-

Evans, Alice Catherine 1881-1975

Fish, Marie Poland 1902

Hill, Justina Hamilton 1893-

Hyde, Ida Henrietta 1857-1945

*Hyman, Libbie 1888-

Mead, Sylvia Earle 1935-

Rathbun, Mary Jane 1860-1943

*Rudnick, Dorothea 1907

*Russell, Elizabeth Shull 1913-

Stevens, Nettie Maria 1861-1912

BOTANISTS AND HORTICULTURISTS

Andrews, Eliza Frances 1840-1931
Bodley, Rachel Littler 1831-1888
Brandegee, Mary Katherine 1844-1920
Britton, Elizabeth Gertrude 1858-1934
Colden, Jane 1724-1766
Furbish, Kate 1834-1931
King, Louisa Boyd 1863-1948
Logan, Martha Daniell 1704-1779
Mexia, Ynes Enriquetta 1870-1938
Phelps, Almira Hart 1793-1884
Pinckney, Elizabeth Waties 1845-1921
Pringle, Elizabeth Waties 1845-1921
Sessions, Kate Olivia 1857-1940
Shattuck, Lydia White 1822-1889
Spry, Constance 1886-1960
Strong, Harriet Williams 1844-1929
Warner, Anna Bartlett 1827-1915

CHEMISTS AND PHYSICISTS

Blodgett, Katherine 1898-
*Brown, Rachel Fuller 1898-
Cori, Gerty Theresa 1896-1957
Curi, Irene 1897-1956
Curie, Marie 1867-1934
*Farr, Wanda K. 1895-
Hamilton, Alice 1869-1970
Horstmann, Dorothy M.
Mack, Pauline 1891-
Mayer, Marie Goeppert 1906-1972

CHEMISTS AND PHYSICISTS (cont'd)

Meitner, Lise 1878-1968
Morgan, Isabel
Quimby, Edith Hinkley 1891-
Richards, Ellen 1842-1911
Sabin, Florence Rena 1871-1953
Seibert, Florence 1897-
Wu, Chien Shiung 1912(?)-
Stielbeling, Hazel 1896-
Telkes, Maria de 1900-
Wrinch, Dorothy M. 1894-
Zakrzewska, Marie 1829-1902

ENGINEERS

Gilbreth, Lillian 1878-1972
Sink, M. Virginia 1913-

HEALTH REFORM ADVOCATES

Baker, Sara 1873-1945
Bissell, Emily 1861-1948
Blackwell, Elizabeth 1821-1910
Breckinridge, Madeline 1872-1920
Crane, Caroline 1858-1935
Daniel, Annie 1858-1944
Davis, Katherine 1860-1935
Davis, Paulina 1813-1876
Dennett, Mary 1872-1947
Dix, Dorothea 1802-1887
Eliot, Martha May 1891-
Fowler, Lydia 1822-1879

HEALTH REFORM ADVOCATES (cont'd)

Gantt, Love 1875-1935

Hunt, Harriot 1805-1875

Jones, Jane 1813-1896

Lakey, Alice 1857-1935

Mosher, Eliza 1846-1928

Nichols, Mary 1810-1884

Packard, Elizabeth 1816-1897

*Pennington, Mary Engle 1872-1952

Sanger, Margaret 1883-1966

Schwartzhaupt, Elizabeth 1901-

Slagle, Eleanor 1871-1942

Stern, Frances 1873-1947

Valentine, Lila 1865-1921

Wells, Charlotte 1814-1901

Yarros, Rachelle 1869-1946

INVENTORS

Jones, Amanda 1835-1914

Knight, Margaret 1838-1914

Masters, Sybilla d. 1720

METEOROLOGISTS

Van Straten, Florence 1913-

NATURALISTS

Bailey, Florence Augusta 1863-1948

Bingham, Millicent Todd 1880-1968

Clark, Eugenie 1922-

Comstock, Anna 1854-1930

Doubleday, Neltje Blanchan 1865-1918

NATURALISTS (cont'd)

Eckstrom, Fannie Pearson 1865-19146

Martin, Maria 1796-1863

Miller, Olive Thorne 1831-1918

Shattuck, Lydia White 1822-1889

Thompson, Alleen 1919-

Van Lawick-Goodall, Jane 1934-

Walcott, Mary Morris 1860-1940

Wright, Mabel Osgood 1859-1934

NURSES

Barton, Clara 1821-1912

Bickerdyke, Mary Ann 1817-1901

Blanchfield, Florence A. 1884-1971

*Breckinridge, Mary 1877-1965

Browne, Dame Sidney Jane 1850-1941

Cavell, Edith 1865-1915

Crandall, Ella 1871-1938

Delano, Jane 1862-1919

Densford, Katherine 1890-

Dempsey, Sister Mary Joseph 1856-1939

*Fredde, Sister Elizabeth 1850-1921

Flikke, Julia Otteson 1879(?)-

Galard-Terraube, Genevieve de 1925-

*Haile Selassie, Princess Tsahai 1919-1942

*Kenny, Elizabeth 1886-1952

Lathrop, Rose Hawthorne 1851-1926

McIver, Peart V. 1893-

*McKinney, Sally Zumaris 1915-

Mahoney, Mary Elizabeth 1845-1926

NURSES (cont'd)

Mance, Jeanne 1606-1673
Maxwell, Anna 1851-1929
*Nienhuys, Janna
Nightingale, Florence 1820-1910
Nutting, Mary 1858-1948
O'Connell, Sister Anthony 1814-1897
*O'Hara, Dee 1935-
Palmer, Sophia 1853-1920
*Pontes, Sister Dulce Lopes
Powell, Louise 1871-1943
Porter, Elizabeth 1894-
Richards, Linda 1841-1930
Robb, Isabel Adams 1860-1910
Sleeper, Ruth 1899-
Stimson, Julia 1881-1948
Taylor, Susie King
Thoms, Adah B. Samuels 1863(?)-1943
Tyler, Adeline 1805-1875
Wald, Lillian 1867-1940
Wilbur, Bernice M. 1911-

NUTRITIONISTS

Davis, Adell 1904-1974
*Metzelthin, Pearl V. 1894-1947

PHYSICIANS

Anderson, Elizabeth Garrett 1836-1917
Apgar, Virginia 1909-1974
*Barrows, Katherine 1845-1913

PHYSICIANS (cont'd)

*"Dr. James Barrie" (real name unknown) 1798-1865
Bennett, Alice 1851-1925
Blackwell, Elizabeth 1821-1910
Blackwell, Emily 1826-1910
Brooks, Matilda Moldenhauer
Broomall, Anna 1847-1931
Brown, Charlotte 1846-1904
Brunswick, Ruth 1897-1946
Buckel, Cloe 1833-1912
Calderone, Mary S. 1904-
Cleveland, Emeline 1829-1878
Cone, Claribel 1864-1929
Cullis, Winifred C. 1875-1956
Cutler, Hannah 1815-1896
DeWitt, Lydia 1859-1928
Dimock, Susan 1847-1875
Dolley, Sarah 1829-1909
Fearn, Anne 1865-1939
Fleming, Lady Amalia 1909(?)-
Fulton, Mary 1854-1927
Hurd-Mead, Kate 1867-1941
Hurdon, Elizabeth 1868-1941
Ilg, Frances 1902-
Jacobi, Mary 1842-1906
Jex-Blake, Sophia 1840-1912
Jordon, Sara 1884-1959
Kugler, Anna 1856-1930
L'Esperance, Elise 1879(?)-1959

PHYSICIANS (cont'd)

Longshore, Hannah 1819-1901
Lozier, Clemence 1813-1888
Marshall, Clara 1847-1931
Mayo, Sara 1869-1930
McGee, Anita 1864-1940
Mergler, Marie 1851-1901
*O'Kelsey, Frances 1914-
*Owens-Adair, Bethenia 1840-1926
*Pechey, Edith 1845-1908
Picotte, Susan 1865-1915
Preston, Ann 1813-1872
Remond, Sarah 1826-1887
Ripley, Martha 1843-1912
*Robbins, Jane 1860-1946
*Stafford, Mary 1834-1891
Scott, Kate Frances 1890-
Sewall, Luch 1837-1890
Sherwood, Mary 1856-1935
Stevenson, Sarah 1841-1909
Stone, Hannah 1893(?)-1941
Summerskill, Edith 1901-
Swain, Clara 1834-1910
Taussig, Helen B. 1898-
Taylor, Luch 1833-1910
Thomas, Mary 1816-1888
Thompson, Mary 1829-1895
*Thorne, Isabel 1836-1917
Tracy, Martha 1876-1942
Travell, Janet G. 1901-

PHYSICIANS (cont'd)

*Uejabul, Pierra 1909-
Underwood, Lillias 1851-1921
Wellstein, Martha 1868-1939
Welsh, Lilian 1858-1938
Wright, Jane C. 1919-

PSYCHOLOGISTS

Ames, Louise 1906(?)-
Brothers, Joyce 1927(?)-
Calkins, Mary 1863-1930
Downey, June 1875-1932
Follett, Mary 1868-1933
Ladd-Franklin, Christine 1847-1930
Freud, Anna 1895-
Hollingsworth, Leta Anna 1886-1939
Horner, Matina Souretis 1939-
Horney, Karen 1885-1952
Martin, Lillian 1851-1943
McHale, Kathryn 1890-1956
Ridenour, Nina 1904-
Shinn, Milicent 1858-1940
Washburn, Margaret 1871-1939
Woolley, Helen 1874-1947
Zachry, Caroline 1894-1945

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SCIENTISTS INCLUDED IN SLIDE-TAPE PRESENTATION, WOMEN IN SCIENCE
by
Joyce Kirchin
Clinton School District

1. Marie Curie
2. Hazel Bishop
3. Maria Mayer
4. Helen Wright
5. Dixy Lee Ray
6. Susan La Flesche Picotte
7. Valentina Tereshkova
8. Mary Calderone
9. Marcia Storch
10. Joyce Brothers
11. Alice Hamilton
12. Katherine McHale
13. Charlotte Sitterly
14. Connie Givon
15. Adele Davis

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